PUBLIC WORKS

June
1956

CITY, COUNTY AND STATE

Calcium Chloride STABILIZATION page 87

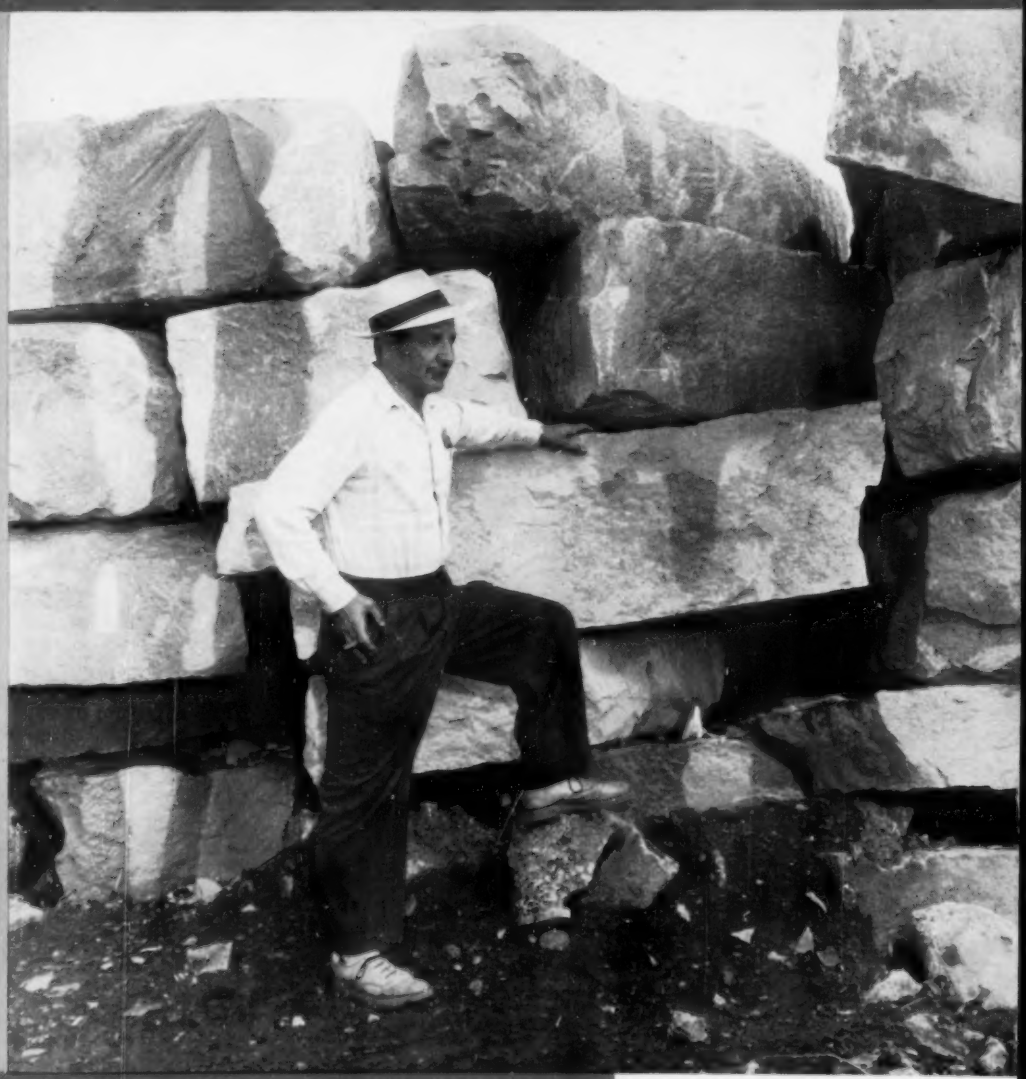
FLUORIDATION and the Courts page 94

How Much POLLUTION Can a Stream Assimilate? page 96

County Road IDENTIFICATION and Rural House Numbering page 105

FLY CONTROL for Cities page 122

COMPLETE CONTENTS LIST ON PAGE 5



C. R. Nicolazzo, Director of the Department of Engineering and Public Works of Kenosha, Wisconsin. See story on page 18.

No one wants to DIG UP a sewer line . . .

THIS ONE IS "LEAK-PROOFED FOR LIFE"* WITH

TYLOX *flexible* RUBBER

PIPE JOINTS

This sewer line in *CORPUS CHRISTI, TEXAS won't have to be dug up in a few years because of leaky or failing joints! In specifying TYLOX Rubber Gaskets, engineers and city officials took advantage of a coupling material **known** for its non-deteriorating, ageless qualities . . . for its ability to make sewerage and drainage pipe joints leak-proof and root-proof for the life of the pipe itself.

But that's not all . . . along with the certainty of permanently water-tight pipe joints, their TYLOX specification assured faster construction and lower job costs. **Flexible** TYLOX is quickly assembled to the pipe, and permits fast assembly of the line. It compensates for pipe angularities . . . permits wet trench jointing . . . immediate backfilling.

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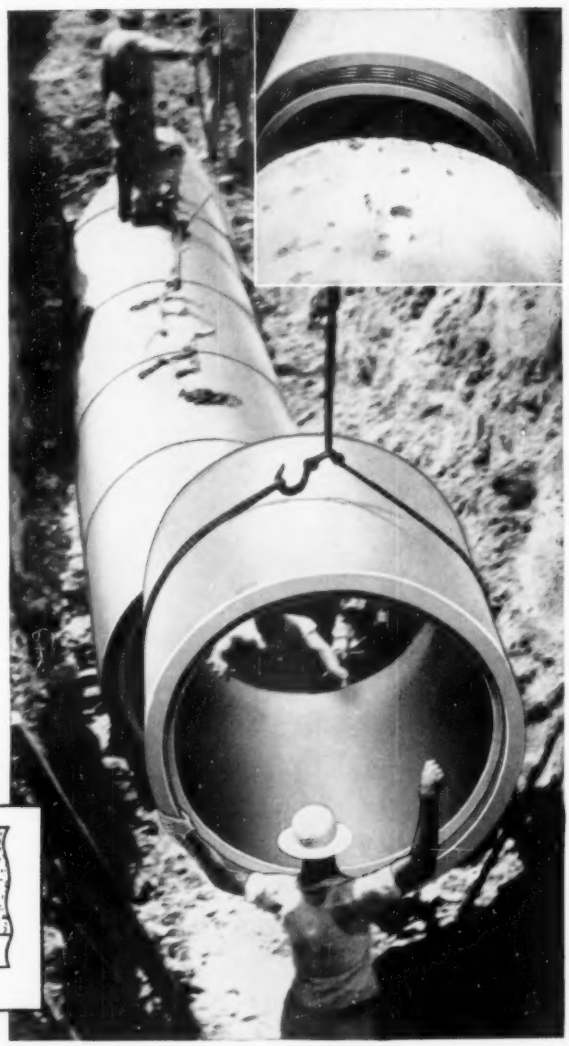

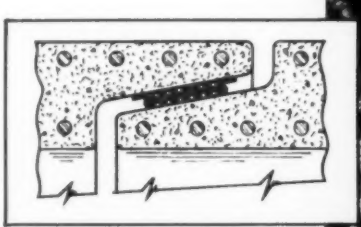

This rubber-tight seal STAYS tight "for the life of the line".

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KENT, OHIO

427 West Grant St. Orchard 3-9555

* **PROJECT:** 48" trunk sewer for City of **Corpus Christi**, Texas

ENGINEERS: For City of Corpus Christi, Texas — Drahn Jones, Dir. of Public Works, and Klyde Z. Huston, Engineer

CONTRACTOR: Heldenfels Bros., Corpus Christi, Texas

PIPE: TYLOX-Jointed, reinforced concrete, furnished by TexCrete Company, Corpus Christi, Texas

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174 175 181 182 183 190 191 196 197 198 199 204
205 206 209 210 211 212 222 224 229 233 234 236
237 239 242 243 252 260 261 263 267 270 271 276
277 278 292 295 298 300 303 306 308 309 311 312
313 319 327 328 330 331 332 334 336 341 342 343
344 351 356 357 358 361 362 364 368 375 381 383
385 393 398 399 417 421 422 424 427 432 433 438
445 446 447 448 449 452 454 458 461 462 463 464
477

New Products, pages 193 to 199

6-1 6-2 6-3 6-4 6-5 6-6 6-7 6-8 6-9 6-10 6-11 6-12
6-13 6-14 6-15 6-16 6-17 6-18 6-19 6-20 6-21 6-22
6-23 6-24 6-25 6-26 6-27 6-28 6-29 6-30 6-31 6-32

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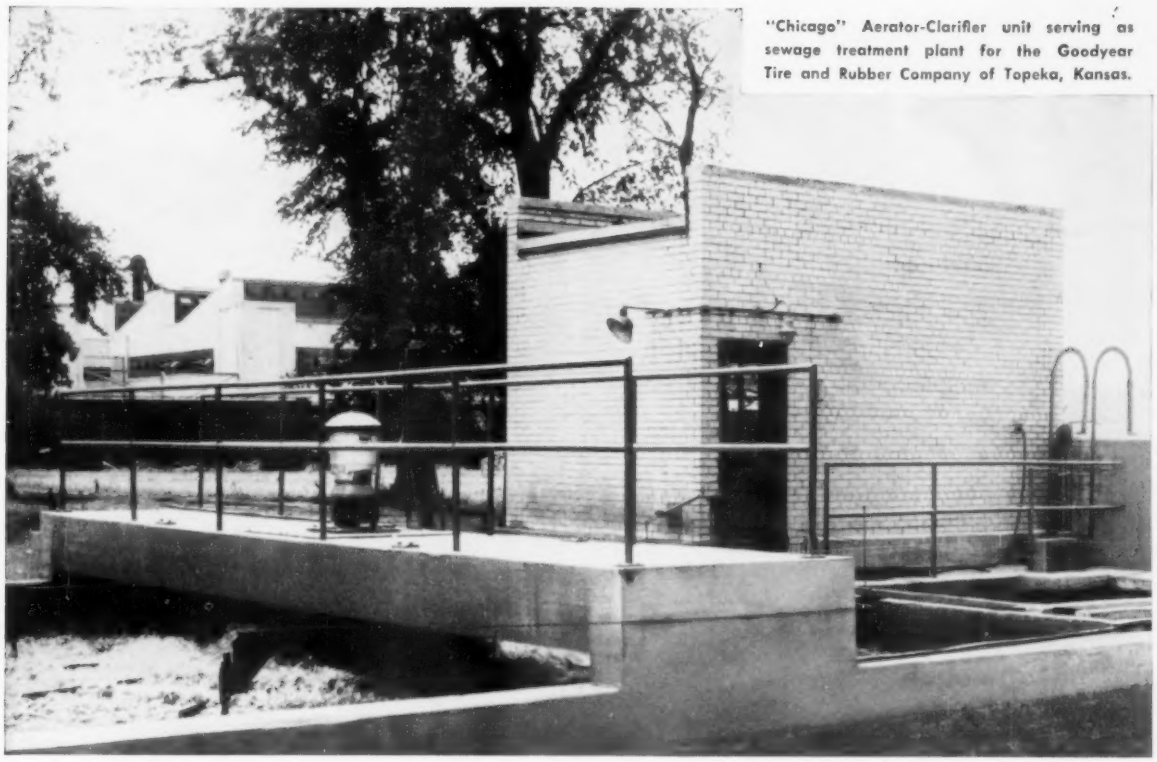

"Chicago" Aerator-Clarifier unit serving as sewage treatment plant for the Goodyear Tire and Rubber Company of Topeka, Kansas.

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from "Chicago"

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"Chicago" Aerator-Clarifier units handle sewage flows from 15,000 to 500,000 gallons per day in single or multiple units. They may be safely located near dwellings as the plants are free from flies, odors, and unsightly appearance.

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Get full details of this month's products . . . mail your Reader's Service card today.

How Yuma gets rid of its trash

The old dump for the City of Yuma, Arizona, was not only an eyesore but a breeder of vermin. Today, thanks to sound planning by City Engineer Mulford Winsor, Jr., and the dependable performance of a Caterpillar HT4 Traxcavator*, refuse disposal has become a civic asset instead of a liability.

Sanitary landfill is not new, but each city adopts it to solve its own problems. In some cases the "area" method is preferred. Yuma uses the "trench and fill" system. The HT4 digs a long trench, some 20 ft. wide and 10 ft. deep. Refuse, brought by the city's 6 trucks, is dumped into the trench, compacted by the Traxcavator, then covered with 2 ft. of clean earth. This process goes on until the trench is filled. No smoldering fires. No rats or flies. The completed section can be planted for park or playground use, or opened for building.

The CAT* HT4 Traxcavator, says Mr. Winsor, has proved a very satisfactory and economical tool for the job.

Now available in the Caterpillar line are 3 new Traxcavators, all ideal units for sanitary landfill: The No. 933 with 1-yd. capacity, the No. 955 with 1½-yd. capacity, and No. 977 with 2¼-yd. capacity. They have superior digging and lifting action and easy maneuverability. All have the new oil-type clutch that lengthens clutch life and minimizes maintenance. Another important feature is 40-degree bucket tilt-back at ground level, assuring a full load at every pass.

Yuma's HT4 Traxcavator is one of nearly 1000 Caterpillar-built machines now capably handling sanitary landfill assignments throughout the world. In the complete Caterpillar line of Traxcavators, bulldozers and scrapers, there is a size and type to match your community's needs.

Your Caterpillar Dealer is equipped to help plan your sanitary landfill and to suggest machinery to fit your disposal problems. See him today.

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PUBLIC WORKS MAGAZINE

CONTENTS

JUNE, 1956 **Vol. 87, No. 6**

Calcium Chloride Stabilization as Related to Soils Bases. *By H. F. Clemmer* 87
Aluminum Cover Protects Water Works Reservoir 91
New Lights Enhance Miami Thoroughfares. *By Ernest A. Fort* 92
Fluoridation and the Courts. *By James A. Tobey* 94
Automatic Lubrication for City Vehicles. *By Carl H. Guider* 95
How Much Pollution Can a Stream Assimilate? *By M. A. Churchill* 96
Coordinating Subsurface Utility Installations. *By Leslie B. Allan* 102
County Road Identification and Numbering of Rural Residences. *By A. K. Branham* 105
New Record System Gives True Water Works Inventory Picture 110
The Composition of Residential Garbage. *By George F. Mallison and William F. Hohloch* 112
Financing an 18 Mile Sanitary Sewer 114
Elm for City Planting is Resistant to Disease. *By Ralph B. Bryan* 115
Prefabricated Catch Basin Sections Save Time and Money. *By A. J. Mair* 117
How Much Paint to Stripe a Mile? 118
Mechanical Composting of Garbage and Sewage Sludge. *By John Grindrod* 119
Fly Control for Cities. *By Carroll N. Smith and J. C. Keller* 122
Analyzing Flows in Water Distribution Systems. *By Robert C. Moore* 124
How Communities Can Attract and Hold Industry. *By Lloyd A. Dixon, Jr.* 126
Fabric-In-Asphalt Solves Bridge Decking Problem 134
Water-Borne Outbreak of Infectious Hepatitis 134
How a Small City Installed Storm Water Drainage. *By R. K. Clark* 141
Planting Trees on Sanitary Landfill 142
Design and Construction of a 13-Mile Interceptor Sewer *By Francis A. Obert* 148
Ohio's Campaign Reduces Accidents at Hazardous Locations 152
Municipal and State Self-Insurance 158
A Modern Traffic Sign Shop 163
Aluminum Extensions Mount Fluorescent Luminaires 164
Air-Powered Pipe Saw Speeds Water Main Repairs 176

PUBLIC WORKS DIGESTS

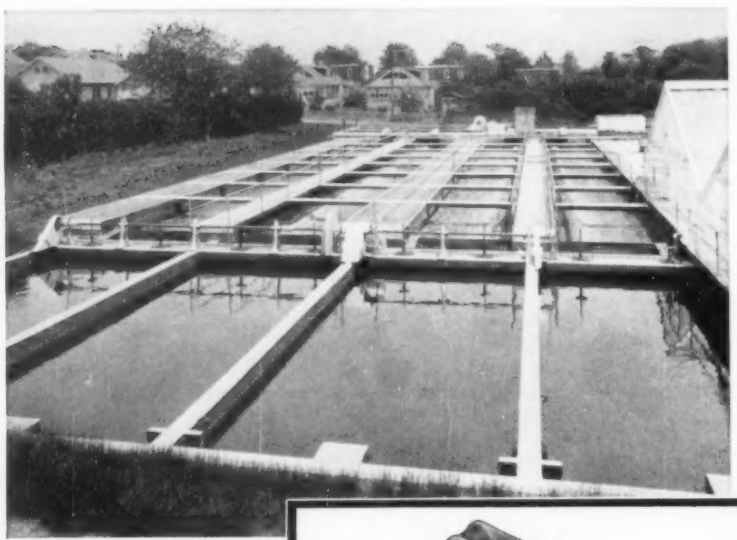
The Sewerage and Refuse Digest 142
The Highway and Airport Digest 154
The Water Works Digest 166
The Industrial Waste Digest 178

DEPARTMENTS AND SECTIONS

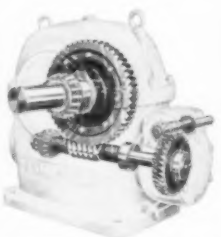
The Editor's Page 7
Leader in Public Works 18
Letters to the Editor 22
The Engineers' Library 32
Up Front for Adequate Roads *By Leo J. Ritter* 60
Public Works Engineering Notes 74
Public Works Legal Notes *By Melvin Nord* 80
APWA News Bulletins 129
Books in Brief 161
Jobs for Engineers 188
New Public Works Equipment 193
Worth Seeing 201
Worth Telling *By Arthur K. Akers* 202

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

How will your judgment on SANITARY ENGINEERING EQUIPMENT look after 15 years?



FOR 15 YEARS, the Link-Belt chain on final tank Straightline Collectors at this Collingswood (N.J.) activated sludge plant rendered dependable service, running 24 hours per day, *without replacement*. Straightline collectors in primary tanks have been in service for 24 years without replacement. Clearness of effluent may be judged by reflection of the drive machinery in final tanks in foreground.



ENCLOSED DRIVES. All types have sturdy gray iron housings, anti-friction bearings and precision gears for long trouble-free operation.

CHAIN. Made of Promal, the longer-wearing pearlitic malleable iron, has toughness, strength, high yield point, high resistance to abrasion.

SPROCKETS. Flint-Rim wheels have smooth, file hard, wear-resisting teeth, assuring maximum life.

LINK-BELT equipment is sturdily designed to last for decades

REMEMBER this when developing specifications and interpreting quotations on your water, sewage or industrial waste treatment system. It pays to give thoughtful analysis to design and equipment which will assure long life with little maintenance. Such scrutiny will also tell you why — in cities large and small . . . in plants of all types — Link-Belt installations continue to deliver top efficiency at lowest operating cost for many years.

Link-Belt offers you a broad line of *quality* sanitary equipment — including screens, collectors, mixers and complete conveying and power transmission equipment. In fact, Link-Belt pioneered such life-lengthening features as Flint-Rim sprockets and Promal chain.

With this wide choice of equipment, you also put Link-Belt's many years of technical experience to work on your needs. These two are your assurance of sturdy design . . . close attention to all construction details . . . a thoroughly tested, tried and proved system.

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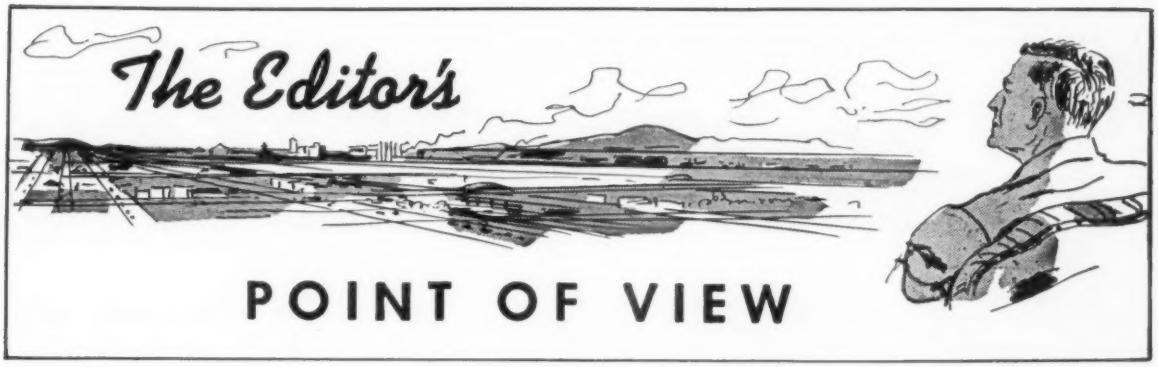


Making Better Use of Older Technically Trained Personnel

INDUSTRY HAS, for the most part, fallen into the habit of retiring its workers before they get very old. There are advantages in this, and also it is probably necessary. However, this reservoir of retired skill can be used to very great advantage and ought to be. The development of satellite and suburban areas into communities which have all of the problems of the neighboring larger cities, though perhaps on a smaller scale, has created a need for personnel trained in public works engineering and in management. These men can be of great value in public service, as city managers and directors of public works. We know a number of men who are filling such jobs with distinction, rendering a valuable service to their communities, and helping to mitigate the present shortage of trained personnel. Just because a man has been retired at a more or less arbitrary age limit is no reason why he cannot carry a full-time job of this nature.

More Research is Needed for Chemical Insect Control

INSECT CONTROL by our "wonder" chemicals —DDT and its relatives and allies—is becoming increasingly difficult as insects are developing resistance to them. Many of the malaria-bearing mosquitoes can no longer be controlled by DDT; body lice in Korea demonstrated almost complete indifference to it; in parts of South America, it has been reported, fleas, potential carriers of plague, are resistant; and in Trinidad control of mosquitoes has not been sufficient to prevent a minor outbreak of yellow fever. For some time it has been evident in this country that flies and cockroaches can no longer be fully controlled with DDT.

This is an area where comprehensive research is needed, both to determine the conditions under which DDT and other like compounds are most effective and to point out the characteristics of needed new compounds. The best use of existing insecticides also needs more study. Perhaps some of the reasons for the reported ineffectiveness of the chemical agents lies in neglect of the obvious and fundamental principles of sanitation and cleanliness. It was found during World War II that DDT did not eliminate the need for good housekeeping. Sound sanitation is still basic in insect and vermin control.

What Are Public Works?

PUBLIC works are those things people cannot do for themselves, but which are essential to community life. Public works are a compound of the engineer imagining the needs, drawing the plans and writing the specifications; of the sweating construction men, the machines they use—bulldozers, tractors, graders, pavers and shovels —and the makers of these machines; of the engineer again, and his maintenance men and equipment, working long hours that the life of the community can continue; for maintenance begins the day construction is ended.

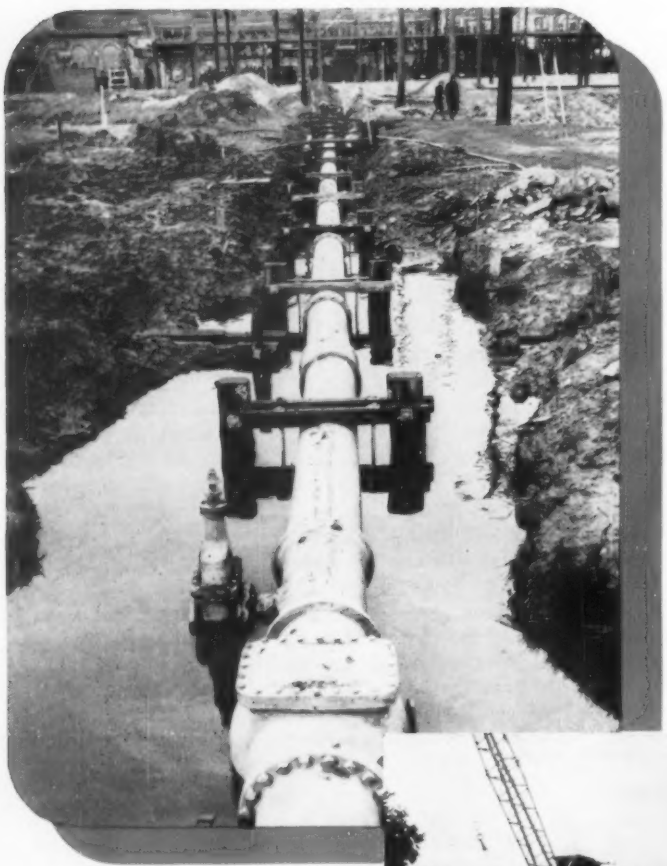
Public works thus are many things, but most of all the way to a better and fuller life, to greater prosperity and a finer world. In the forefront are always the engineers, dreaming and making their dreams come true in wider and safer highways; in pure water; in waste rendered harmless; and in a multitude of other ways for the betterment of all.

Navy Pioneers "Preventitive" Medicine Program

A RECENT RELEASE by the Navy Office of Information states: "A program to stop sickness before it starts is now being pioneered by the Navy. Preventitive Medicine Unit No. 5, located on the . . Naval Hospital Grounds . . has been assigned the task of developing techniques to prevent sickness, individual or epidemic, before it starts."

Those folks who have been engaged in preventive medicine activities over the last two score years will be happy to know that the Navy has, at last, realized the importance of undertaking such measures. If the work could be put on a sounder and broader basis than is indicated by the announcement, and full use made of the skills of engineers and other scientifically trained personnel, we might almost forgive the spelling of that third word in the heading of this comment, and also the implication contained in the word "pioneered."

You can bank on it for jobs



20" Mechanical Joint Water Feeder Main installed at Atlantic City, N. J.

About 14 miles of 16" Mechanical Joint pipe installed for supply line for water district in South Carolina.

When your reputation is at stake... when the public deserves and should get dependable service... play safe by installing cast iron pipe. Through our consistent program of national advertising, the public knows that cast iron pipe serves for centuries—is reliable and economical. Today, *modernized* cast iron pipe, centrifugally cast, is even tougher, stronger and more uniform in quality than the pipe our industry made a century ago. For further information, write Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3.

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The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

Nearly two miles of 6" to 20" cast iron pipe for potable, process, and fire protection water systems and sewer system for petrochemical plant in Tuscola, Illinois.

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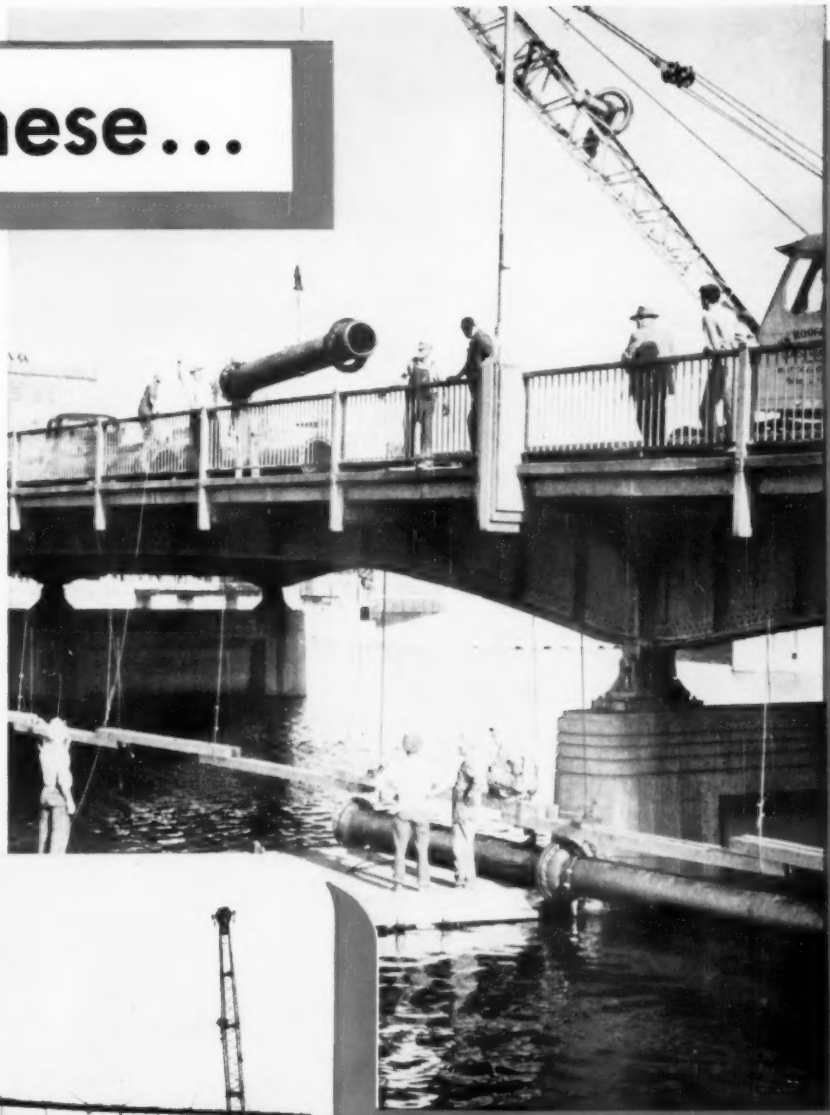


Flexible Joint cast iron pipe being laid across 600 feet-wide river at Waterloo, Iowa, for feeder line operating under 85 psi water pressure.

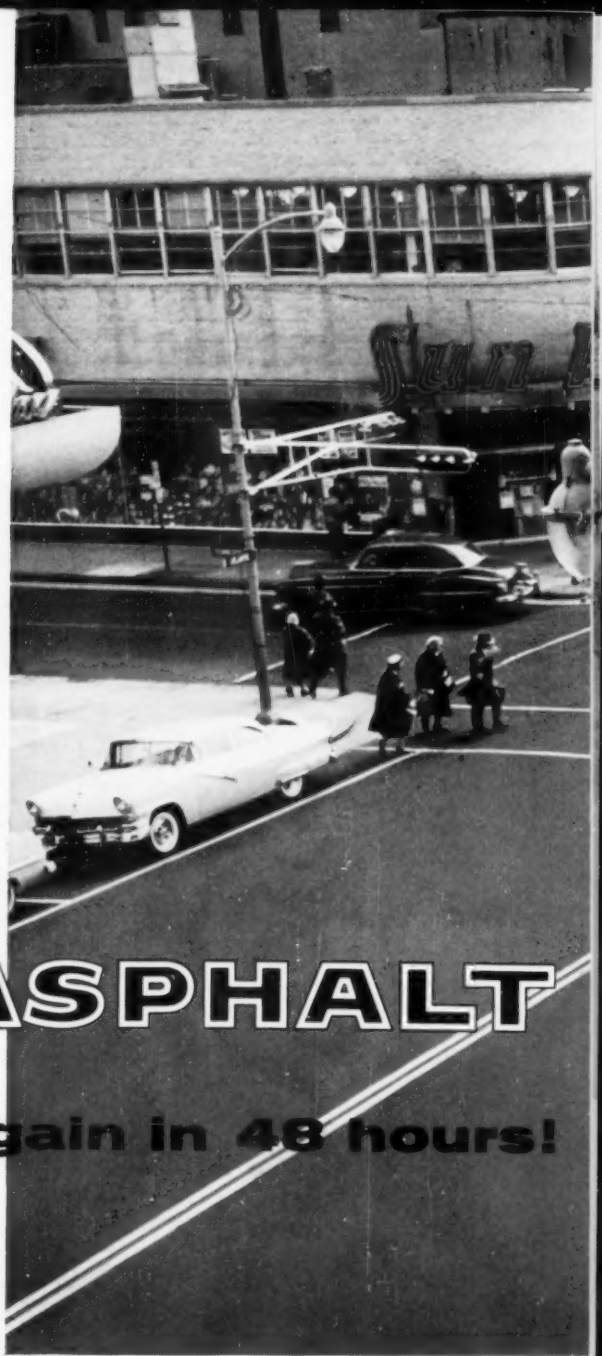
Installing 24-inch Flexible Joint cast iron pipe for river crossing at Fort Lauderdale, Florida.

SERVES FOR CENTURIES...

Thousands use our Readers' Service card to keep up to date . . . do you?

"Asphalt proved economical... for Atlantic City's growing traffic loads," says Major William F. Casey, Public Works Commissioner, Atlantic City

"Asphaltic pavement permitted excellent construction speed," says Mr. George Swinton, City Engineer, Atlantic City



Repaved with ASPHALT

Traffic rolls again in 48 hours!

Atlantic City renews main artery with minimum business loss . . . 3 blocks at a time every 2 days

Asphalt construction is the speediest way to repave.

George Swinton, City Engineer of Atlantic City, does it three blocks at a time . . . based on a laying rate of 1200 tons/day. Like this:

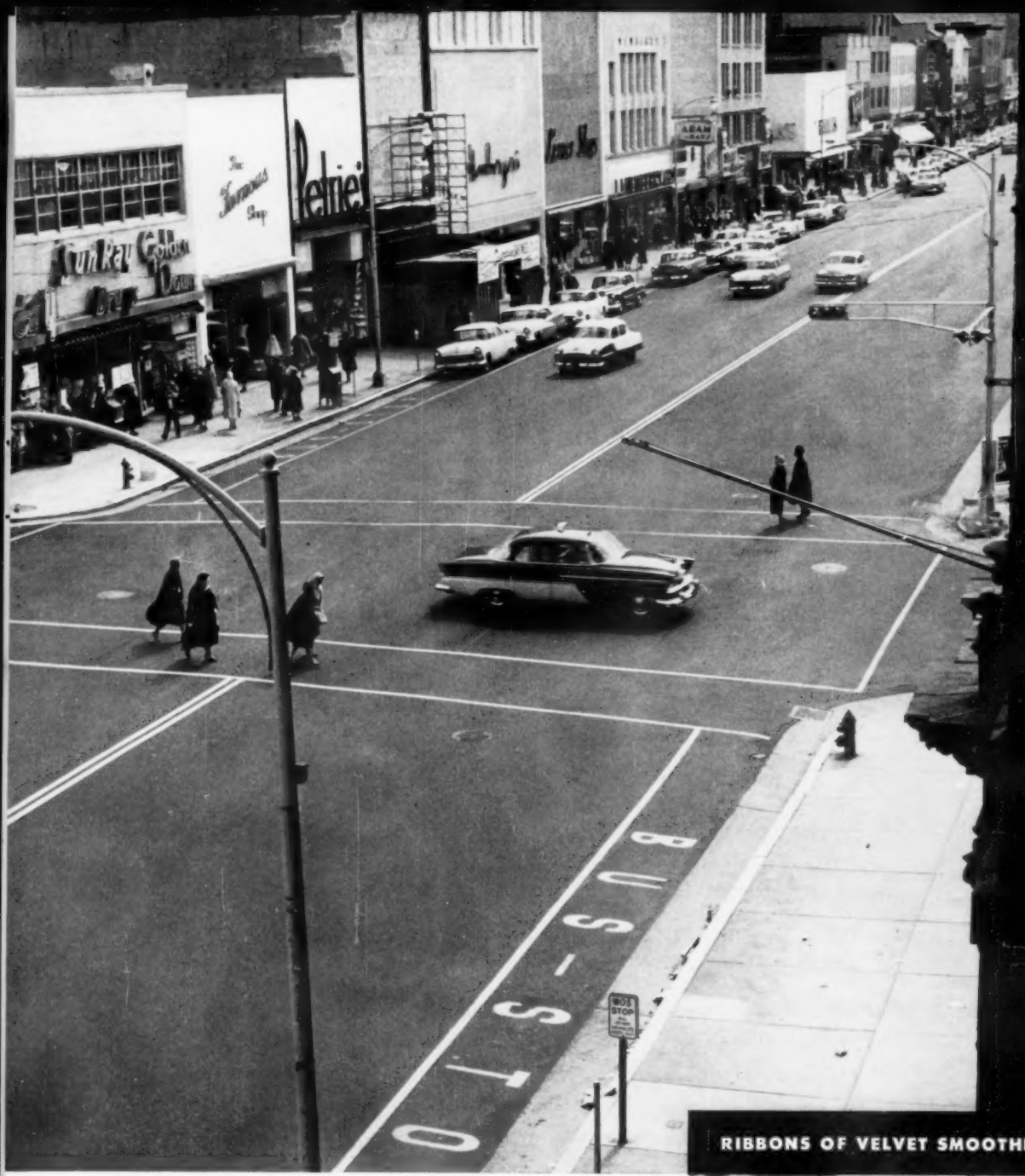
First Day . . . barricade three blocks; jackhammer out worn portions of old paving; fill holes, burn; apply tack coat; lay and roll a 2" asphalt fine-aggregate base; start laying 1½" asphalt wearing surface.

Second Day . . . finish to grade; paint traffic markings; organize equipment and materials for next day's start; open section to traffic.

Using this fast-moving asphalt method, the city repaved its famed 3.1-mile Atlantic Avenue (see photo) weeks ahead of both schedule completion date and resort season. Furthermore, interruption to the business of Atlantic Avenue merchants was scarcely more serious than that of a rainy day.

What's more, with asphalt, cost was low . . . as Mr. Casey, the city's Public Works Commissioner, indicates above. Low first cost. Reduced "mortgage" on future taxes, too. For asphalt is a minimum-maintenance pavement. Smooth. Resilient. Tough. Good for years. Lends itself well to patching after utility tear-ups.

You are in a good strategic position when you plan for asphalt construction. Good with the public.



RIBBONS OF VELVET SMOOTHNESS...

Good with fund watchdogs. Good from the standpoint of sound engineering. Asphalt makes new paving or repaving programs easier to swing.

For an informative booklet, write for "From the Ground Up." For planning help, call for an Asphalt Institute Engineer. At the address below.

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are used in

Trickling Filters

at

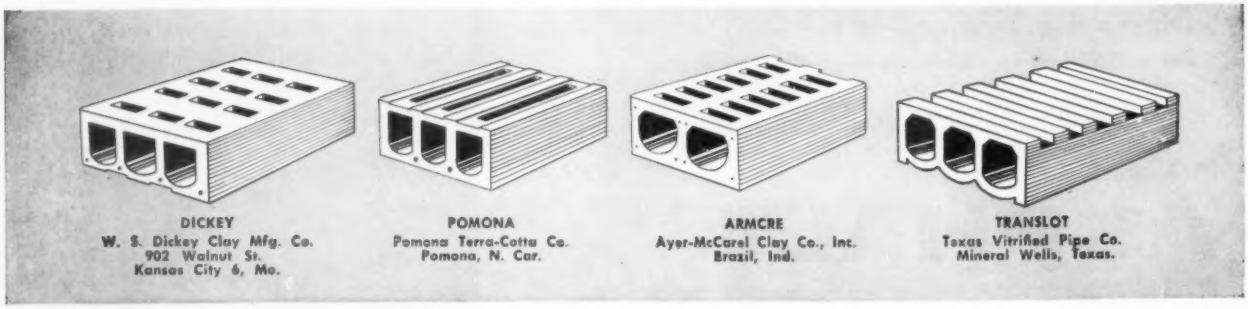
ALEXANDRIA, VIRGINIA

The growth in area population and the increasing pollution of the Potomac River necessitated a sewage treatment plant that could serve both the City of Alexandria, Virginia, and portions of neighboring Fairfax County, too, as a joint project. To provide for the potential tremendous growth in this area an 18 mgd single stage trickling filter plant, including TFFI specification underdrains, was decided upon. It is expected to be in operation in July 1956.

6 GREAT ADVANTAGES

Among the six great advantages of trickling filters with TFFI vitrified clay underdrains are their ability to handle overloads —temporarily or for the long pull—as new industries and populations are added, within reasonable limits. Plus these other desirable features: simplicity and reliability of operation, long life, low costs, durability, and good results. Get these advantages in your filters by specifying TFFI blocks.

TRICKLING FILTER



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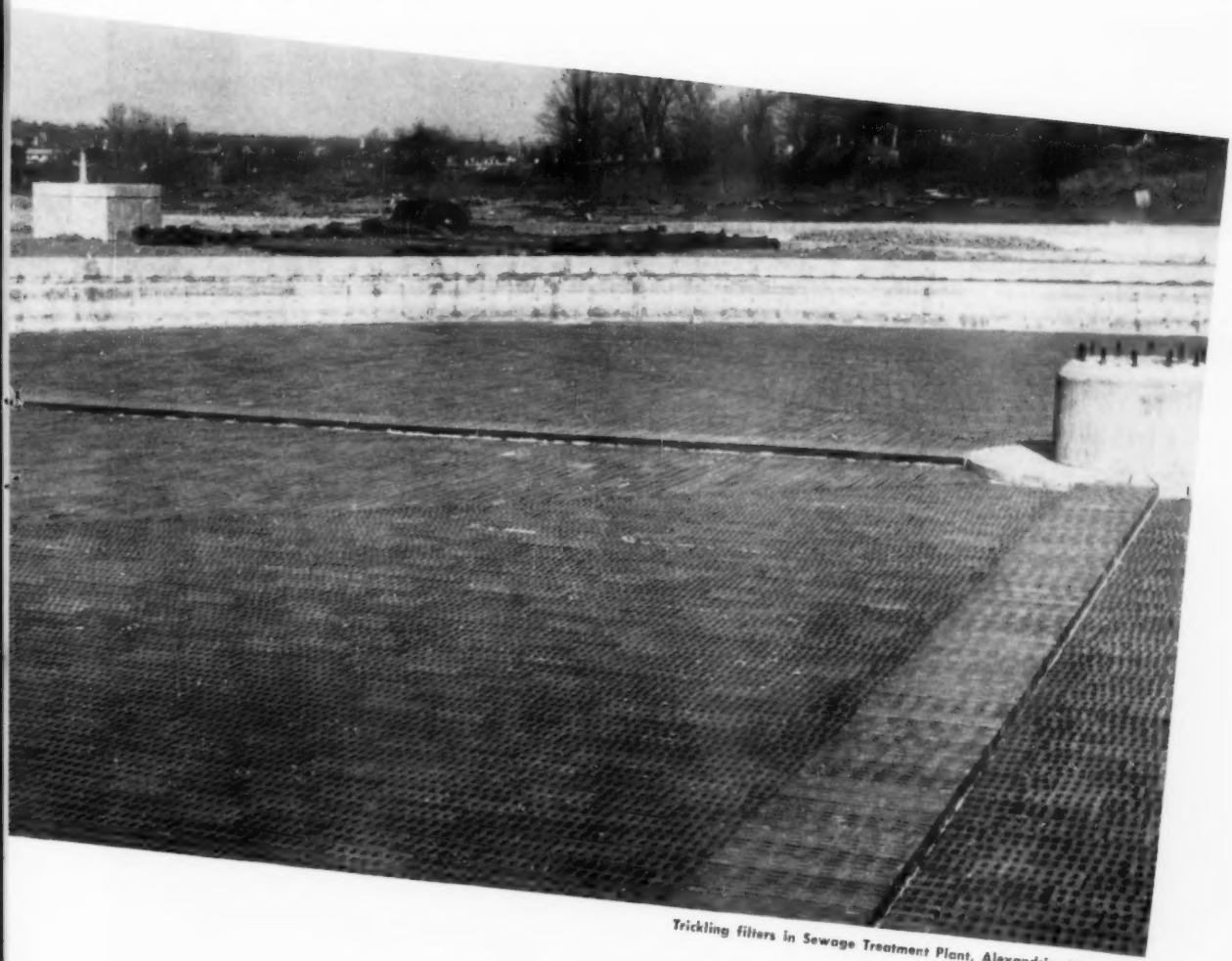


Trickling filters in Sewage Treatment Plant, Alexandria, Virginia

Designed by Greeley & Hansen, Consulting Engineers, Chicago 4, Illinois

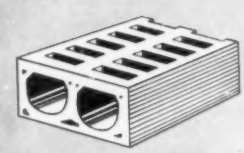
Construction by James McHugh Construction Co., Chicago 37, Illinois

Equipment: Pumps: Worthington, Yeomans, and Marlow; Rotary Distributors, Walker Process Equipment Inc.; Gas control and heat exchanger, Pacific Flush Tank Co.; Sludge Gas Engines, Climax Engine & Pump Mfg. Co.; Chlorinators, Wallace & Tiernan and Fischer & Porter. Digester Equipment, Dorr-Oliver Inc.

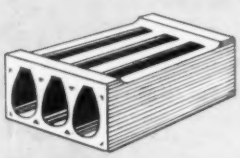
TFFI SPECIFICATIONS

For underdrains are contained in pages 37 and 38 of the new TRICKLING FILTER HANDBOOK under "Standard Specifications for Vitrified Clay Filter Blocks for Trickling Filters." Available from any TFFI member.

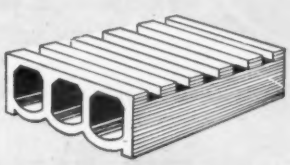
FLOOR INSTITUTE



BOSCO
Bowerston Shale Co.
Bowerston, Ohio



NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.

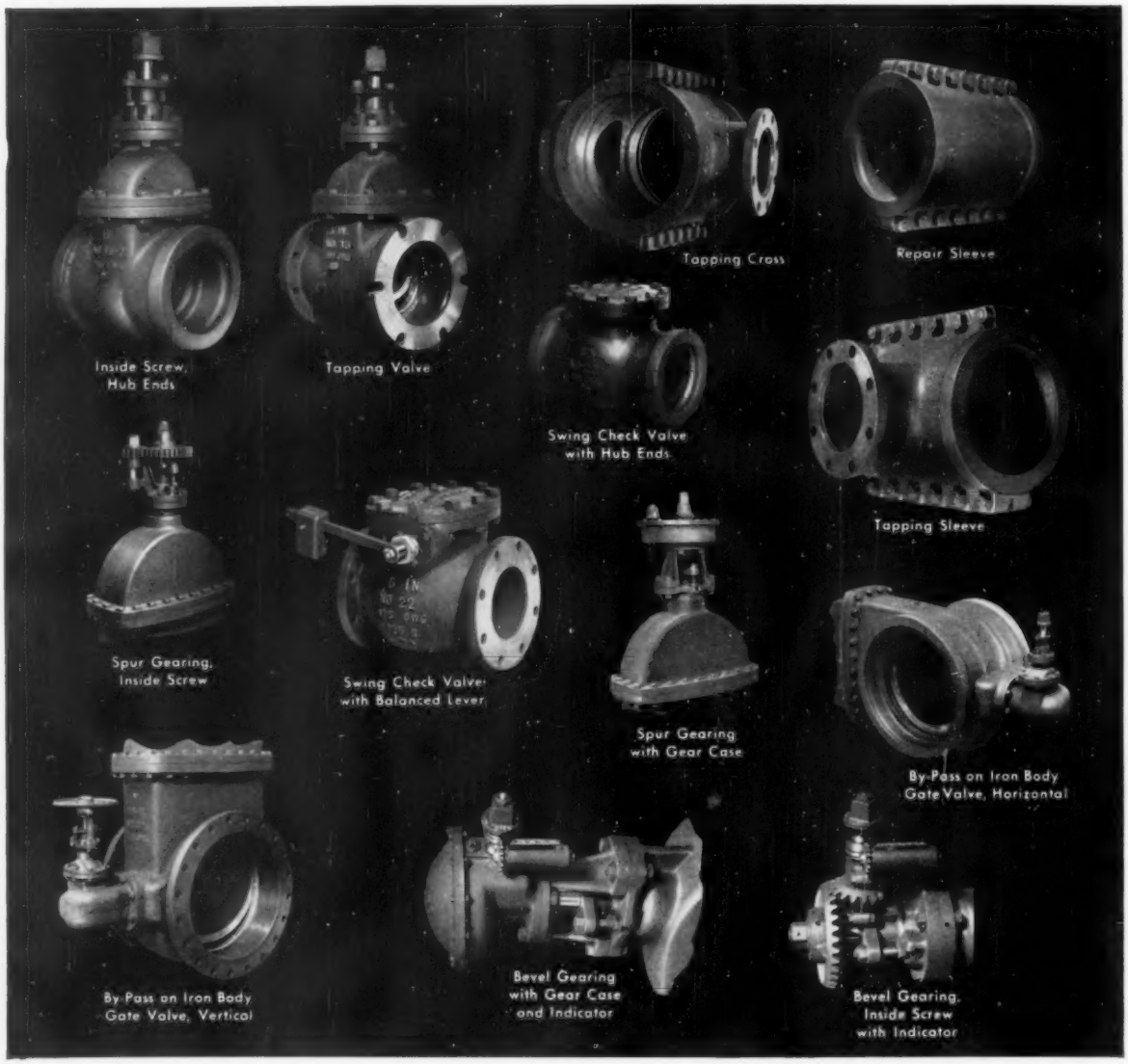


TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

TFFI

Symbol of
good treatment

Get full details of this month's products . . . mail your Reader's Service card today.


Inside Screw, Hub Ends
Tapping Valve
Tapping Cross
Repair Sleeve
Swing Check Valve with Hub Ends
Tapping Sleeve
Spur Gearing, Inside Screw
Swing Check Valve with Balanced Lever
Spur Gearing with Gear Case
By-Pass on Iron Body Gate Valve, Horizontal
By-Pass on Iron Body Gate Valve, Vertical
Bevel Gearing with Gear Case and Indicator
Bevel Gearing, Inside Screw with Indicator

DARLINGS . . . good for YOUR system

TRADE DARLING MARK

THIS composite picture gives you a rough idea of the broad range of Darling valves and allied products engineered for water distribution systems. What you cannot see here, naturally, is the unexcelled Darling quality—carefully controlled from Darling's own foundry all the way through final assembly and test. Nor can you "picture" performance advantages such as offered only by Darling's fully revolving double disc gate valve principle. For items such as shown here . . . and Darling's revolutionary B-50-B hydrants . . . it will pay you to check with Darling.

DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

Now's the time to mail this month's Readers' Service card.

Planning better roads

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt

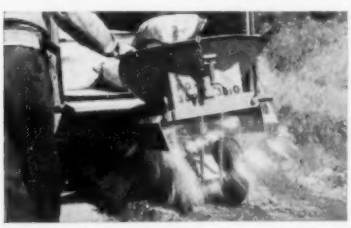
Stabilizing Shoulders with Rock Salt Costs Less . . . Gives Added Safety

Highway officials in many states have found that stabilizing road shoulders with rock salt is economical for two reasons. First, rock salt is relatively low in cost—and even with lower-grade materials, it helps provide better-wearing shoulders. Secondly, shoulders made with rock salt provide substantial savings in road maintenance. These shoulders have high density, so the aggregate is not readily blown or eroded away. And they actually protect the roadway itself by preventing water from seeping under the pavement edge.

From the safety standpoint, rock-salt-stabilized shoulders have the necessary load-bearing hardness to support emergency traffic in all weather. Soft-shoulder accidents are eliminated—and blinding dust is no longer a hazard. These modern shoulders also provide excellent drainage, so that water, snow and ice will not collect on the road surface.

To show how simple—and economical—it is to stabilize shoulders with rock salt, here is an actual step-by-step story of how this method was used on a U. S. Highway with a high traffic count. For safe, efficient stabilization of the shoulders, Sterling Rock Salt, produced by International Salt Company, was chosen.

1. The first step was to scarify and mechanically mix the shoulders to a depth of 4". Bank-run dirt with good clay content was added, as well as ¾" No. 2 stone, until proper mixture was attained.



2. Then, 6 lbs. of Sterling Rock Salt per square yard was spread on the shoulders. Application of this rock salt was by rotary spreader. After this process, materials were again dry-mixed.

3. Next, the shoulder was thoroughly wetted down. After wetting, soil was again mixed mechanically. Additional wettings were needed throughout this procedure, so that soil had optimum moisture content.

4. After mixing and wetting, all the materials were then bladed to a proper level for rolling. To provide for adequate drainage of water, a slope of at least one-half inch per foot was maintained on the shoulders.

5. Final step was rolling with rubber tires. Because rock-salt-stabilized materials compact more than unstabilized materials, the 6" depth of loose material was compacted to about 4" by rolling.

This stabilization procedure varies with particular soil and road conditions. For expert advice on how stabilization can work in *your* area, contact International.

FREE TECHNICAL ASSISTANCE ON ROAD STABILIZATION

International Salt Company will be glad to help you work out an effective, economical rock-salt road-stabilization program for your system. There's no cost or obligation. Just contact your nearest International sales office.

For further technical information on rock-salt stabilization, write for International's free series of booklets, "Better Highways." Address: International Salt Co., Inc., Scranton 2, Pa.

Sales offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR ROADS, INDUSTRY, FARM, AND HOME—

STERLING SALT

PRODUCT OF INTERNATIONAL SALT CO., INC.

"Our TD-6 DROTT 4-IN-1 can do more city jobs faster and cleaner than any other rig I've seen"

—George E. Davis,
Superintendent of
Sanitation and Streets,
Rockwood, Tennessee
(Population: 5,000)

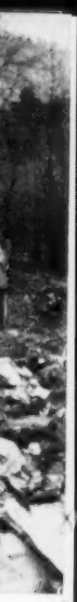
FIRST **"First we use our Four-In-One in bulldozer, or in clamshell position** to spread or spot-place the mixed rubbish and garbage evenly. We have about 40 packed cubic yards of material to dispose of daily, six days a week."

THIRD **"Third, with Bullclam action,** under accurate *clam lip* control, we spread an even cover of six inches of dirt over each layer of refuse. Because of good compaction of the refuse, and the even spreading of cover dirt, this proves to be about right."

Now, the International Drott Four-In-One is available in three sizes

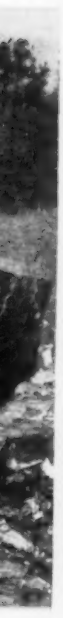
1 YARD	1½ YARD	2¼ YARD
TD-6	TD-9	TD-14

1-yard TD-6; 1½-yard TD-9; 2¼-yard TD-14. See how your city can beat the material-handling usefulness of a fleet of limited-duty machines—for a Four-In-One's moderate price. See your International Drott Distributor for a Four-In-One demonstration.



SECOND

"Second, we use compactor plate action which the operator gets instantly on the go. He can also apply hydraulic down-pressure to compress bulky refuse into minimum volume, ready to cover. It doesn't take long to really flatten materials like tin cans, cartons, etc."



FOURTH

"Our fourth step is ironing down the cover dirt, again using compactor plate action —this time with the added pressure of a ton of dirt. This makes a rat-proof, odor-proof seal; also destroys fly and mosquito hatcheries. We find, too, this step speeds decomposition of refuse."

4-1

"And for a final cover," adds Mr. Davis, "we apply a two-foot layer of dirt on the completed sanitary fill. Our Four-In-One is mainly used on this work but at times we use it on street work and for back-filling sewer trenches. Besides cutting our old-method refuse disposal time in half, the outfit gives us 4-machine usefulness, to do more city jobs, faster and cleaner, than any other rig I've seen."

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 8, Wis.

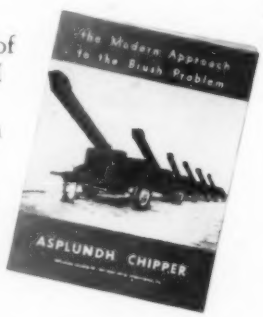
INTERNATIONAL HARVESTER

INTERNATIONAL®
DROTT

IF YOU **HAUL** AND **BURN** BRUSH YOU'RE SPENDING TOO MUCH **MONEY** FOR BRUSH DISPOSAL

The modern, money-saving way is to use an ASPLUNDH CHIPPER. It's *engineered* for low maintenance, for trouble-free service. And there are many *exclusive features* of the ASPLUNDH CHIPPER that can be of real benefit to you.

The whole story of how ASPLUNDH CHIPPERS can help you is told in a booklet, "THE MODERN APPROACH TO THE BRUSH DISPOSAL PROBLEM"



To get your copy of this free, informative booklet, just fill in and mail the coupon below . . . it will pay you to know!

Demonstration easily arranged at your convenience, without obligation.

ASPLUNDH CHIPPER COMPANY
505 York Road Jenkintown, Pa. Dept. W-2

Please send me FREE BOOKLET, *The Modern Approach to the Brush Problem*

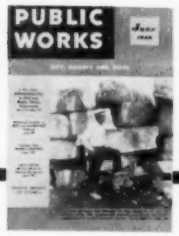
NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

BY ACTUAL TEST THE FASTEST CHIPPER MADE

Get full details of this month's products . . . mail your Reader's Service card today.



LEADER IN PUBLIC WORKS

C. R. Nicolazzo, Director of the Department of Engineering and Public Works of Kenosha, Wisc., attended the University of Wisconsin and Denison University, graduating in 1930. He has a civil engineer degree and is a registered professional engineer. In Kenosha, a city of 56,000, he is responsible for all street, sewer and water works engineering, construction and maintenance; and also for refuse collection and disposal. The picture on the cover shows him at the breakwater protection project being constructed along the lake shore. The stones used on this job are not less than four tons in weight and some weigh 15 tons. Under his direction, the water department so expanded its capacity that Kenosha was one of the few mid-west cities that imposed no restriction on water use last summer.

He entered on active duty in February, 1941, as a 1st Lt., Corps of Engineers, which was his reserve rank. He was assigned to the Air Force Technical Training Command and served at a number of posts in this country. He was promoted through the various grades to the rank of Colonel in May, 1945, and reverted to an inactive status in June, 1946. He was awarded the Legion of Merit for his work in airfield construction. He has been with Kenosha since 1946.

Mr. Nicolazzo holds membership in the American Water Works Association and in the American Public Works Association. He is married and he and Mrs. Nicolazzo have two daughters. His hobbies are, he says, carpentry and boating; but R. H. Custer, City Manager, says they also include good administration and hard work.

Transportation. Over the roughest terrain, through sand, soft earth or mud, in good weather or bad, the Universal 'Jeep'†, with the extra traction of its 4-wheel drive, takes supervisory personnel, work crews, tools, equipment and supplies wherever they are needed. It shifts easily into conventional 2-wheel drive for quick highway travel between jobs.

Ten billion miles of proof!*

One of the reasons why so many 'Jeep' vehicles are used in public service

Hauling and towing. The "go-anywhere" 'Jeep' Truck is the only truck in its weight class originally designed and engineered completely for 4-wheel drive off-the-road travel. It carries one-ton payloads... tows heavily loaded trailers.

Mobile power. The Universal 'Jeep', with power take-off or hydraulic lift, takes power right to the job to operate this trencher and many other types of equipment including winches, grader blades and sprayers or dusters.

Maintenance. The 4-Wheel-Drive 'Jeep' Utility Wagon carries up to 110 cubic feet of bulky cargo, or six passengers. It takes supervisors, workers and tools to maintenance operations other vehicles can't reach.

It's easy to see why economy-minded officials everywhere are turning to 4-Wheel-Drive 'Jeep' vehicles for public works and public service operations. They are the only 4-wheel drive vehicles in their weight class that are time-tested and performance-proved in more than 10 billion miles* of on-the-job transport service. Their "go-anywhere" dependability provides extra insurance in daily public service use and in emergencies.

Only Willys has so many years of experience in engineering 4-wheel drive vehicles in the under 6000 GVW weight class. 'Jeep' vehicles help stretch tax dollars through their long life, low upkeep and high resale value. Ask your Willys dealer for an on-the-job demonstration, or write for information.

The 'Jeep'® family of 4-Wheel-Drive vehicles

WILLYS...makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

*An understated estimate of the miles of transport service driven by 'Jeep' family vehicles. Some estimates place the mileage at more than *fifty* billion.

†Model CJ-5 shown.

Thousands use our Readers' Service card to keep up to date . . . do you?

Gets More

A combination of powerful "pry-out" action using breakout pads as a fulcrum for leverage and a 40° bucket tip-back *at ground level* gets BIGGER LOADS with less spillage.

Keeps More

Heaped loads are cradled closer to the machine for greater stability and can be carried at lower level. Exclusive load shock-absorber cushions the load during travel, smooths out the ride, and permits faster movement with less spillage.

Delivers More

Since you get MORE to begin with and keep MORE while traveling at higher speeds . . . with less spillage in both instances . . . the result — you *deliver* MORE. This new PAYLOADER is a more PRODUCTIVE machine which will handle more yardage at lower cost.

Need more facts about advertised products? Mail your Readers' Service card now.

more yardage at lower cost...
New 2¼ yard PAYLOADER®

The new model HO is the finest four-wheel-drive tractor-shovel ever offered. All the *exclusive* features that increase yardage output enable it to handle many kinds of jobs never before practical with wheeled tractor-shovels.

It operates easier and faster, rides smoother, with or without a load, than anything near its size. It has *balanced* design and durability throughout to turn out big production day after day. If you want *proof* of its *productive capacity* and superior *performance,* ask your "PAYLOADER" Distributor for a demonstration.

Safety and Stability

The safest and most stable wheeled tractor-shovel ever built. Moving members cannot injure operator because of underslung boom arm design and positioning. With loads carried lower and closer to the machine, cushioned during travel, and with longer wheel-base, the utmost in stability is achieved.

More Production, Less Effort

Power-steering, power-brakes on all four wheels, power-shift with no clutching or stopping for range changes and good balance and riding qualities reduce operational fatigue — promote full production all day.

Digging Power

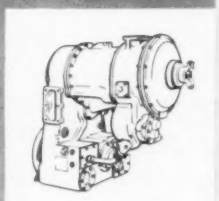
Pound for pound, the new model HO has more traction and digging power — for a wider range of ground conditions—than any wheeled tractor-shovel ever built.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

Torque-Proportioning Differentials *Reduce Wheel Slipping*

Another exclusive "PAYLOADER" feature which assures better traction under adverse conditions. If one wheel starts to spin, more power is delivered automatically to the other wheel.

Rugged planetary final drives in the wheel hubs, plus hypoid differential gearing keep torque low in axles, prolong life of drive-train parts as well as axles.



Complete Power-Shift Transmissions

"Complete" since ALL shifts can be made instantly and on-the-go, under full engine speed. There's NO STOPPING for a range-shift, there's no foot clutch pedal. With the forward-reverse control, the operator can "inch" the machine while maintaining full engine speed to provide maximum bucket lifting and dumping power. Torque converter drive cushions power-train shocks.

THE FRANK G. HOUGH CO.
761 Sunnyside Ave., Libertyville, Ill.
Send information on "PAYLOADER" tractor-shovels:

☐ model HO 2¼ cu. yd. heaped, 1¾ cu. yd. struck
☐ model HH 1¾ cu. yd. heaped, 1½ cu. yd. struck
☐ model HU 1 cu. yd. heaped, ¾ cu. yd. struck

Name_____
Title_____
Company_____
Street_____
City_____ State_____

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Cleveland® "95" digs 10 miles for airfield lighting system at Portsmouth, N. H. Air Force Base

Morrison-Knudsen Company, Inc. and Landers & Griffin, Inc. employed a Cleveland Model 95 "Baby Digger" to good advantage in the construction of the airfield lighting system for the Strategic Air Command's 4,500-acre, $60,000,000 Jet Base at Portsmouth, N. H. The Cleveland dug approximately 52,000 feet of trench 17 inches wide by 27 inches deep for the installation of cable and duct.

The "Baby Digger" was also profitably used on the same project for the excavation of some 3,600 feet of underdrain pipe trench, approximately 2 feet wide by 5 feet deep. As the photograph above shows, much of this trenching was done in rocky, stony soil, definitely not what could be termed "easy going."

The dependable Cleveland steadily delivered good daily trench footage—as it had been counted upon to do—in spite of the rugged digging and adverse conditions encountered. Just another example of Cleveland's ability to *dig more trench . . . in more places . . . at less cost.*

Talk it over with your Cleveland distributor

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND®

Now's the time to mail this month's Readers' Service card.

CAST IRON PIPE FOR COBB COUNTY

In your February issue was an article describing the Cobb County, Ga., water system development. No reference was made in that article to the tremendous amount of cast iron pipe that has gone into that system. I have looked back through our records from 1950 and find for the six-year period, 1950 to 1955 inclusive, our company has sold Cobb County some 752,000 feet of cast iron pipe, or approximately 142 miles, in sizes 6-inch through 24-inch. I would hazard a guess that the total, in either footage or dollar value, would be far in excess of that of any other material that went into the construction of this system. Cobb County is still laying around 180,000 to 190,000 feet of cast iron pipe per year and, from the way that section is growing, it would appear that this expansion will continue.

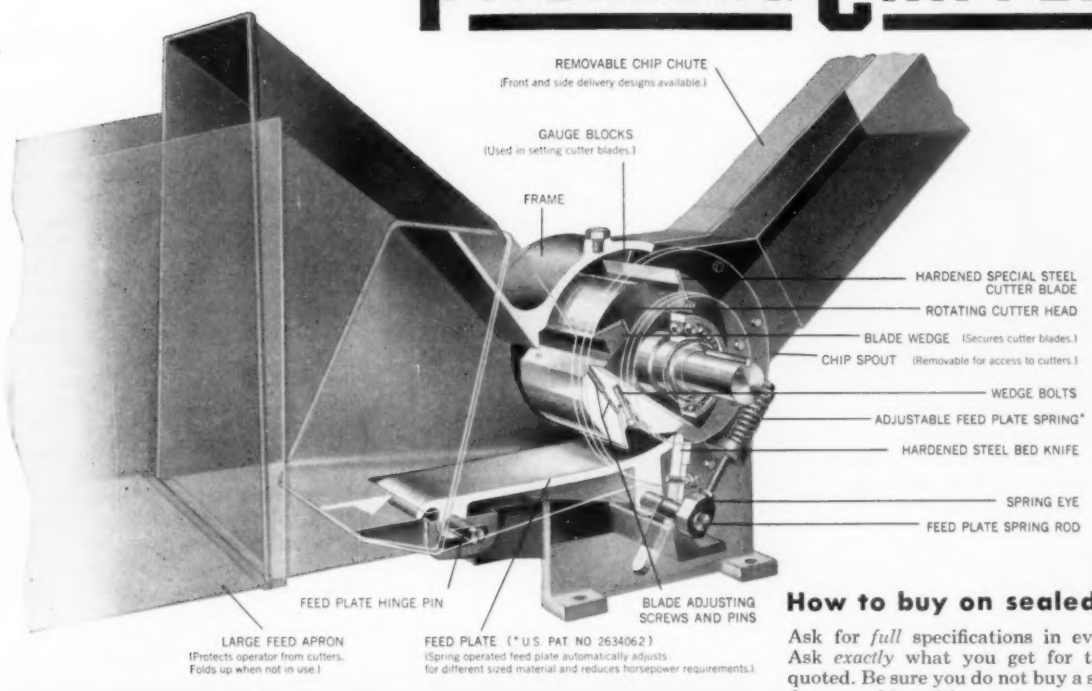
Carl N. Brown
Sales Manager—Pipe
United States Pipe & Foundry Co.
Birmingham, Alabama

WOMEN'S AUXILIARY FOR TEXAS W&SWA

It is both my privilege and my pleasure to be in the position to inform you of the creation of THE STATE AUXILIARY OF THE TEXAS WATER AND SEWAGE WORKS ASSOCIATION during the annual Short School just completed at the A & M College of Texas. Due to the role you always play in our Short School, I felt as if you would want to know about this new organization. Therefore, I am very happy to be the one to send it to you. I am enclosing a copy of our Constitution and By-Laws, our membership card, our registration blank, and anything else that might interest you.

Twelve of us will be listed as "Founders" when we are officially chartered at the completion of the 1957 Short School. These founders

Here's the inside story of time-saving, labor-saving FITCHBURG CHIPPERS


REMOVABLE CHIP CHUTE
(Front and side delivery designs available.)
GAUGE BLOCKS
(Used in setting cutter blades.)
FRAME
HARDENED SPECIAL STEEL CUTTER BLADE
ROTATING CUTTER HEAD
BLADE WEDGE (Secures cutter blades.)
CHIP SPOUT (Removable for access to cutters.)
WEDGE BOLTS
ADJUSTABLE FEED PLATE SPRING*
HARDENED STEEL BED KNIFE
SPRING EYE
FEED PLATE SPRING ROD
FEED PLATE HINGE PIN
BLADE ADJUSTING SCREWS AND PINS
LARGE FEED APRON
(Protects operator from cutters. Folds up when not in use.)
FEED PLATE (*U.S. PAT. NO. 2634062)
(Spring operated feed plate automatically adjusts for different sized material and reduces horsepower requirements.)

GET FULL SPECIFICATIONS—*Know what you buy*

SPECIFICATIONS: FITCHBURG CHIPPER *(unit guaranteed for workmanship and material for one year.)*

CHIPPING UNIT MODEL (Trailer Type)	TWC-6	TWC-612	TWC-9	TWC-915
Diameter of cutter head	9½"	9½"	11½"	11½"
Length of cutter head body	6"	12"	9"	15"
Number and length of cutter blades	4—6⅜"	4—12⅜"	4—9"	4—15"
Type of blade	Special High-Chrome, High-Carbon Tempered Steel			
Cutter head shaft size, (diameter)	1¾"	1¾"	2½"	2½"
Shaft keyway size	⅜" x 3/16"	⅜" x 3/16"	⅝" x 5/16"	⅝" x 5/16"
Approximate weight of chipper only	415#	650#	630#	1,000#
Maximum knife setting	1/16"	¼"	⅜"	⅜"
Capacity—maximum size round (limbs, etc.)	4½"	4½"	7"	7"
maximum size width (slabs, etc.)	6"	12"	8½"	14½"

All units equipped with exclusive *Fitchburg Safety Spring*-activated feed plates (U.S. Patent No. 2634062)

POWER UNIT — Gasoline fuel.				
Number of cylinders	4	6	6	6
Cu. In. Piston Displacement	162	226	226	251, 330, or 427
Water Cooled	Yes	Yes	Yes	Yes
Electric starter and generator	Yes	Yes	Yes	Yes
Clutch Power Take-Off	Disc Clutch	Disc Clutch	Disc Clutch	Disc Clutch
Battery	6-volt	6-volt	6-volt	6-volt
Governor	Var. speed	Var. speed	Var. speed	Var. speed
Oil level and pressure gauge	Yes	Yes	Yes	Yes
Water temperature gauge	Yes	Yes	Yes	Yes
Ammeter	Yes	Yes	Yes	Yes
Key ignition switch	Yes	Yes	Yes	Yes

Power Units are the enclosed type, with industrial engines of proper horsepower and torque ratings.

TRAILER UNIT. All welded steel construction. Steel I-Beam axle. Steel hubs with roller bearings. Drop forged ring-type tow bar to fit Army-type pintle hook. Safety chains. Front and rear legs, front retractable jack-type with steel caster, rear adjustable for height. Automotive drop-center type wheels. 6-ply Commercial pneumatic tires, ranging from 6.00 x 16 to 7.50 x 16 6-leaf springs of 3,500# capacity. Trailer equipped with combination tail light and number plate bracket, with tail light operated by toggle-switch on motor panel (stop light furnished when required). Tire tread widths range from 63" on TWC-6 to 72½" on TWC-915. Fenders and tool boxes are standard equipment. **EQUIPMENT.** Proper sheaves and high-capacity v-belts. Feed apron, chip spout, side delivery chute, 2-piece truck loading chute with chip deflector. Belt guard. Extra set of cutter blades with each unit. Tools furnished consist of necessary Allen wrenches, handle, 3 gauges, honing stone, can of grease, grease gun adapter. Operating and parts manuals. Fitchburg Chippers supplied with standard gray paint unless otherwise requested.

Specifications subject to change without notice

Some of the many uses for your Fitchburg Chipper: **STORM DAMAGE • PARKS • ROADSIDE CLEARANCE • CHRISTMAS TREE DISPOSAL • DUTCH ELM DISPOSAL • SHADE TREES TRIMMINGS • HIGHWAY CONSTRUCTION**

FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

How to buy on sealed bids

Ask for *full* specifications in every bid. Ask *exactly* what you get for the price quoted. Be sure you do not buy a stripped-down machine with extras to come. (Every Fitchburg Chipper is a complete machine, ready to operate.)

Compare the specifications on this page. See why so many cities, towns, commissions, power companies, treemen, and contractors buy Fitchburg Chippers—the only chipper with a written ONE YEAR GUARANTEE, the only machine with the patented spring-activated feed plate. (This feature provides equally smooth chipping of *all* wood sizes to machine's rated capacity.) Another exclusive feature is the hinged feed apron which can be closed when chipper is not in operation.

Fitchburg Chippers have no heavy fly wheels with their warm up period and resulting disadvantages in start-stop operation. Consequently, there is no danger of clutch strain or frequent bearing failure. Fitchburg Chippers are also known for their relative quietness—an important feature when operating on city streets.

COUPON BRINGS FREE DATA

Get the facts—get them now. There is no obligation, mail this coupon today.

FITCHBURG ENGINEERING CORPORATION
Fitchburg, Massachusetts, Dept. PW-66

Send FREE Fitchburg Chipper Data.

(NAME) (POSITION)

(ADDRESS)

(TOWN OR CITY) (STATE)

Get full details of this month's products . . . mail your Reader's Service card today.

Use Northern Gravel for Rapid Sand Filter

The new Northeast Station in the City of Detroit, which is scheduled for completion in 1956, is one of the major projects included in the water department's expansion program. The Northern Gravel Company furnished 120 carloads of filtering materials for the 48 rapid sand filters incorporated in this plant.

Filter Sand Specifications

are carefully laid out. The Effective Sizes and Uniformity Coefficients used by Consulting Engineers and also recommended by the American Water Works Association are the result of long years of research and experience.

The Northern Gravel Company is equipped to give you prompt shipment whether it be one bag or many carloads, exact to specifications. Filter sand can be furnished with any effective size between 0.35 MM and 1.20 MM.

Chemical Quality

of the filter sand is also important. It must be hard, not smooth, and free of soluble particles. This requires perfect washing and grading facilities. We have every modern device for washing, drying, screening and testing.

Filter Gravel

supporting the Filter Sand Bed must be, in turn, properly graded to sizes calculated to support the Filter Sand, and be relatively hard, round and resistant to solution.

Northern Gravel has no equal in facilities and our reserves of both sand and gravel are inexhaustible. Northern Gravel Company has been in business over 40 years. We guarantee uniformity of products and our records enable us to duplicate your requirements on short notice. Our location is central and we have commodity rates in every direction.

Northern Gravel Company

Muscatine, Iowa

Box 307 Ph.: Amherst 3-2711

are: Mrs. Victor M. Ehlers of Austin; Mrs. Sidney L. Allison of Corpus Christi; Mrs. W. S. Mahlie and Mrs. Phillip G. Becker, Jr., of Fort Worth; Mrs. LeRoy N. Rice, Jr., of Harlingen; Mrs. C. W. Stephenson of Temple; Mrs. D. B. Dickson of Dallas; Mrs. C. R. Brock and Mrs. K. V. Stutts of Houston; Mrs. Rae A. Ramzel of Amarillo; Mrs. Floyd Johnston of Refugio; and Mrs. J. T. Watts of Woodville.

The State Officers of The Auxiliary are Mrs. Sidney L. Allison, President; Mrs. Winfield S. Mahlie of Fort Worth, Vice President and program and social chairman. Mrs. LeRoy N. Rice, Jr., is Secretary-Treasurer (and incidentally, "jack-of-all trades" this year since I am serving in the capacity of reporter, historian, etc.) and is automatically editor of "The Pipette . . . Newsletter for Ladies," the Auxiliary journal in miniature, which will be edited here in Harlingen in April, July, October, and January. The April issue has now gone to press.

We organized for the simple purpose of our own social enjoyment, but in thirty days our organization has almost tripled in size and plans are being made to *do* things . . . scholarships, traveling libraries; and other worthwhile purposes will be added in amendments to our by-laws when we convene in 1957!

I have written you as I have because I am terribly proud of our new State Auxiliary and I know that you will be proud, too!

(Mrs.) Emily Rice
P. O. Box 469
Harlingen, Texas

OPPORTUNITIES IN RECLAMATION ENGINEERING

While reading the excellent articles on "Opportunities in Civil and Public Works Engineering" especially the article concerning "The County Engineer," I re-evaluated and appreciated more than before the experience and knowledge that I gathered while working with the Crow Wing County Highway Department in Minnesota.

Reading the articles also calls to my attention the similarity of broad engineering understanding, management and accounting knowledge that a Program Engineer with the Bureau of Reclamation must have properly to perform the duties of his position.

Possibly the opportunities in Program Engineering for young en-

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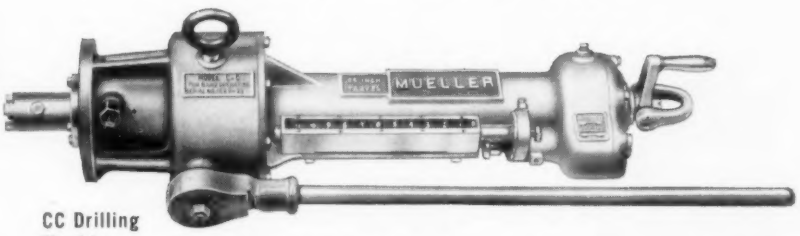
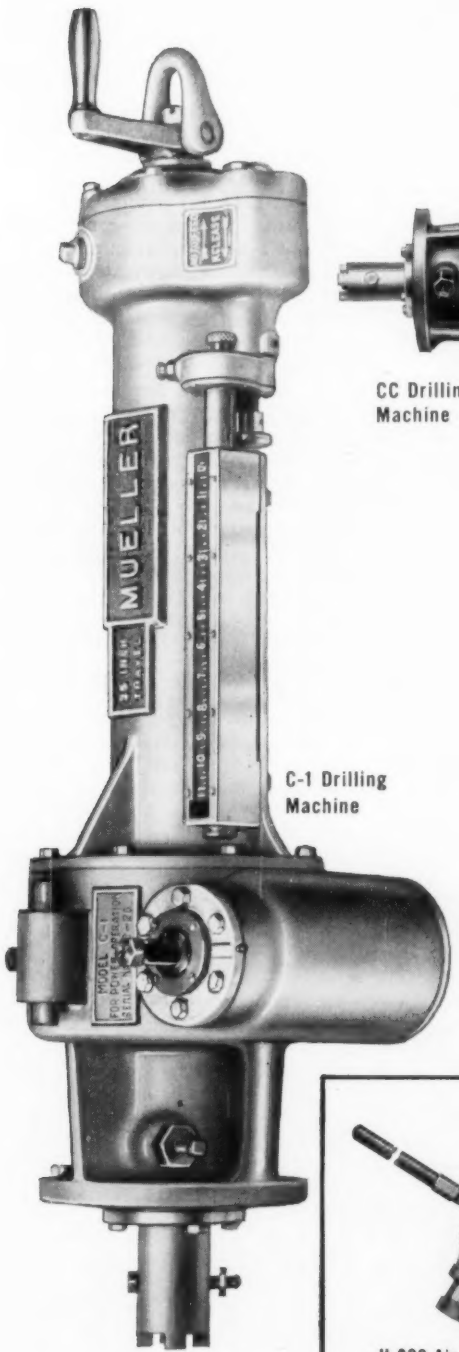
MUELLER

Make cuts 2″ through 12″ in any kind of pipe!



CC Drilling Machine

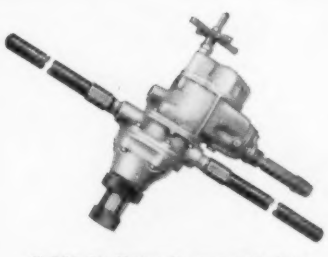


C-1 Drilling Machine

MUELLER Drilling Machines offer:

- 25″ Boring bar travel
- Hand or power operation
- Air or gasoline power units
- Automatic or manual feed
- Standard feed indicator
- Pressures to 500 p.s.i. at 100° F.
- Temperatures to 500° F. at 250 p.s.i.

Install control valves, connect branch mains and make other water works installations – all under pressure.



H-600 Air Motor for use with C-1 Drilling Machine. H-602 gasoline drive unit also available.

Contact your Mueller Representative or write direct for complete information.

MUELLER CO.

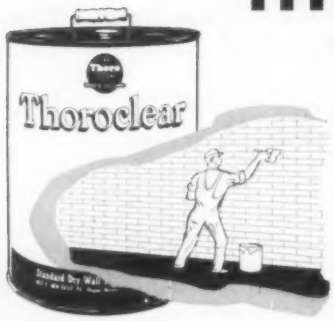
Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

The THORO System of Masonry Protection

THOROCLEAR

Invisible Water Repellent



Ask your dealer about this powerful silicone water repellent developed by years of research by General Electric Company and now produced by us for your protection. *Ask for Circulars No. 30 and 31.*

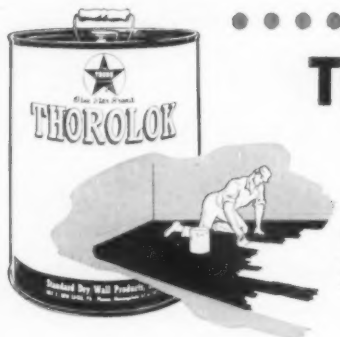
No change in color or texture of brick, limestone, sandstone, tile or stucco surfaces. Applied by brush or spray.

Keep water out of your masonry walls and protect interior plaster, paints and expensive furnishings.

THORITE

20 Minute Set Patching Compound

Repair those broken sills, steps, concrete floors, chimneys and other defective masonry! *Ask for circular No. 20.*



THOROLOK NO. 100

Use it for your basement or factory floors. New, with special alkali resistant pigments. *Ask for Color Card 32-C.*

Manufacturers of

WATERPLUG, THOROSEAL, QUICKSEAL

for all types of masonry protection!

GET OUR PICTORIALLY DESCRIBED LITERATURE "HOW TO DO IT"

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNSYLVANIA

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gineers have been overlooked. Using a typical example for a Reclamation project: The project may start with construction investigations and planning when it may be only an idea, suggested by farmers seeking help to irrigate their farms. It develops through all of the various stages from preliminary investigations to repayment possibilities; through the final construction; and then on to the operation and maintenance of the project.

Details are many. The Program Engineer contacts professional representatives from planning, irrigation, surveys, geological, design and construction, power, etc., and works them to establish a total estimated cost of investigations, construction and subsequent operation and maintenance, and replacements. Conversion of these estimates into timetables produces programs that form the basis for budgeting, work execution and other uses.

A least common denominator embracing estimates, budgets, programs, accounts and reports requires the Program Engineer to know accounting principles and terminology and that he also acquaint himself with legislative and legal principles. The establishment of programs involving construction of multipurpose dams; power plants; irrigation canals; laterals and drains; and water, sewer, electrical and housing facilities fully utilize his engineering ingenuity.

He details the program, in continuity with good construction principles, the material, equipment, and man-power markets and many other requirements such as repayment arrangements with water users, and rights-of-way negotiations. His program must also consider seasonal operations. His contacts are numerous and he must have a smooth temperament for he is also a salesman.

A single project has been discussed above. Consider that ten to twenty such activities are progressing simultaneously from one headquarters. As can be appreciated, the all-around professional engineer in this field must possess a good measure of good management ability. A stout heart is also helpful.

I have found the work interesting, educational and fascinating, and believe that young engineers can gain an impressive background by becoming involved in this type of engineering.

Francis H. B. George
Billings, Mont.

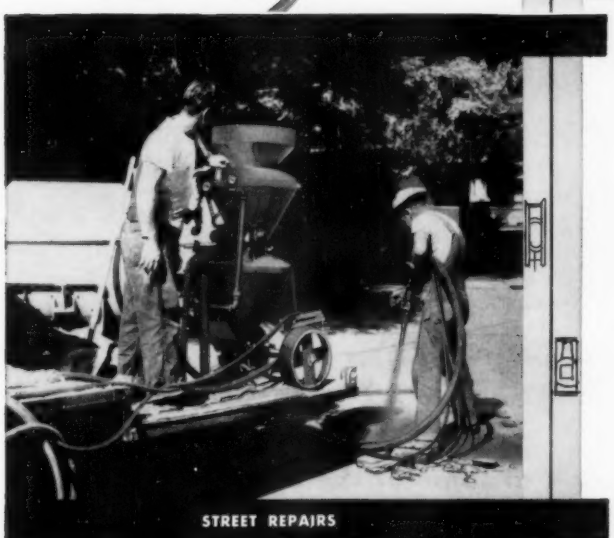
THE AIRPLACO PORTABLE RIG — consists of NUCRETOR or BONDACTOR, MIX-ELVATOR and SAND-LOADER and can be hitched onto a pickup or compressor truck for maximum portability.

Here's the Equipment that's *Streamlining* Street and Curb Repairs...

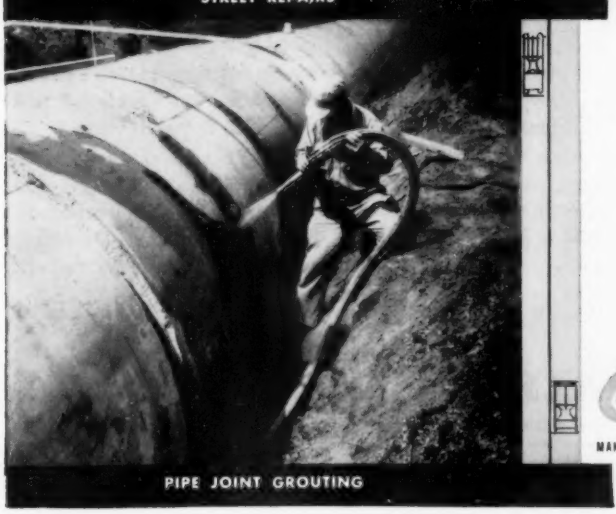
...and lowering the cost!

The AIRPLACO®

PORTABLE CONCRETE GUNNING RIG



STREET REPAIRS



PIPE JOINT GROUTING

Whether you are repairing curbing, streets, sidewalks, bridge abutments, reservoirs or doing any other type of concrete repair or restoration, the job will go much faster . . . much smoother . . . and at a big savings when you put the new AIRPLACO Portable Rig to work.

The AIRPLACO Portable Rig combines efficiency, portability and adaptability all into one unit. It can be moved quickly and easily from one job site to another. Operation is fast with the AIRPLACO SAND-LOADER and MIX-ELVATOR working together loading materials into the AIRPLACO BONDACTOR* or NUCRETOR* And what could be more efficient than to gun your concrete with any one of the AIRPLACO BONDACTORS or NUCRETORS?

AIRPLACO concrete gunning equipment is available in a wide range of sizes to fit your production and job requirements from ½ to 7 cubic yards of aggregate per hour, and using air compressors with 75 to 600 CFM capacity.

*Registered Trade Name

FREE CATALOG!

See your AIRPLACO distributor or write today for your complimentary catalog of AIRPLACO Concrete Gunning Equipment. This catalog will answer many of your questions about this modern, efficient equipment.

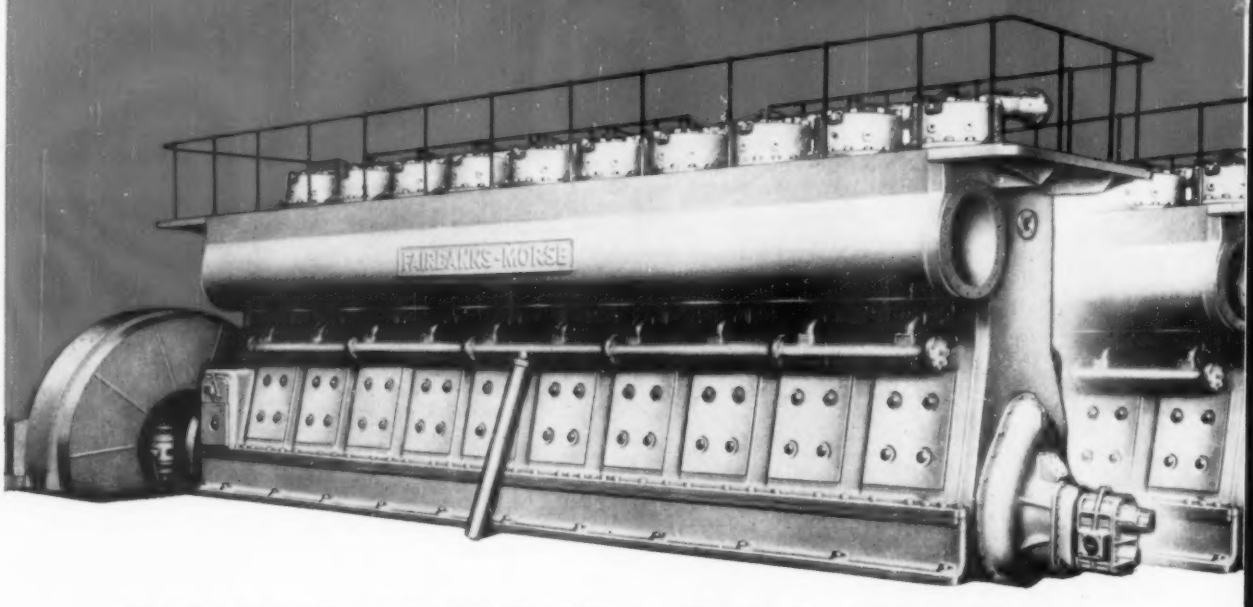
AIRPLACO® **AIR PLACEMENT EQUIPMENT CO.**

1013 WEST 24TH ST. • KANSAS CITY 8, MO.

MANUFACTURERS OF ADVANCED DESIGN CONCRETE GUNNING, MIXING AND PUMPING EQUIPMENT

Now's the time to mail this month's Readers' Service card.

Fairbanks-Morse tops REA



Record 43,300 Hp. Performance

In the top four plants of the national REA competition, there is more than two and a half times as much Fairbanks-Morse horsepower as in all other engines combined—a total of 43,300 horsepower.

Never before has there been such a clear-cut record of efficiency, on such a broad base, in favor of any engine in this competition.

Look at some of the figures:

- First, F-M horsepower produced more than 2/3 of the total power generated by the top four winning plants.
- Three 3500 horsepower Model 31A's generated 82% of the power in the top award-winning Johnson plant.
- Two exclusive F-M powered plants placed second and fourth with only a spread of .1 mill between them.
- One Model 31 in the Top Plant carried the highest penalty of longest operation on straight oil—yet efficiency was higher than plant average.

Here, in engine after engine, is a record of operating standards of efficiency unequaled by any other engine in such numbers.

You Can't Make a Better Power Buy Than a Fairbanks-Morse Diesel or Dual Fuel Engine

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES
HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

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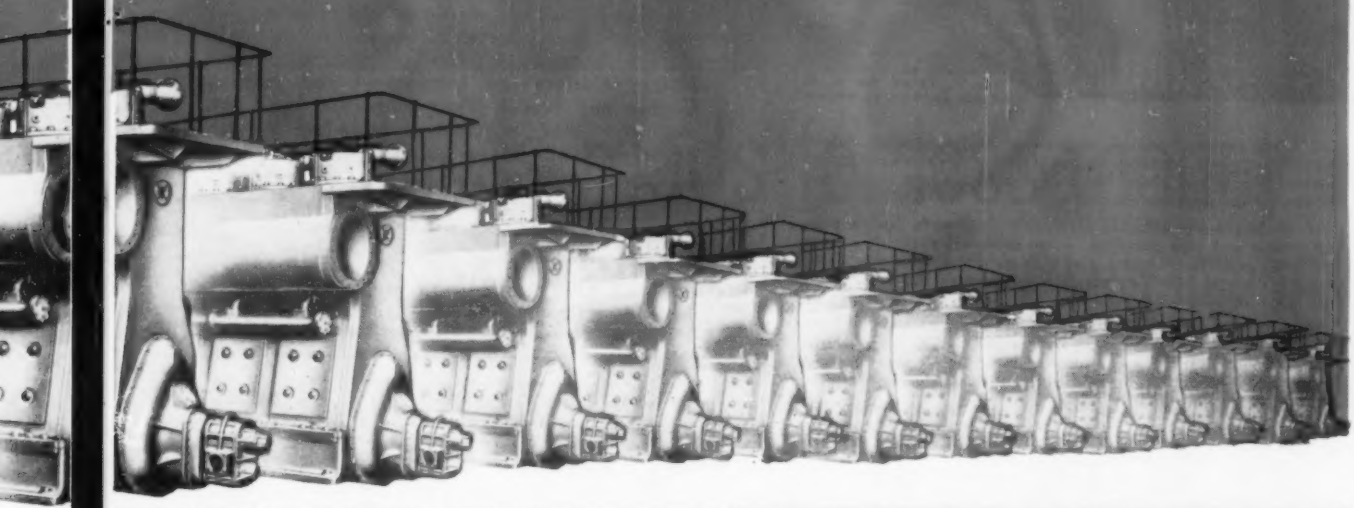
mass efficiency competition



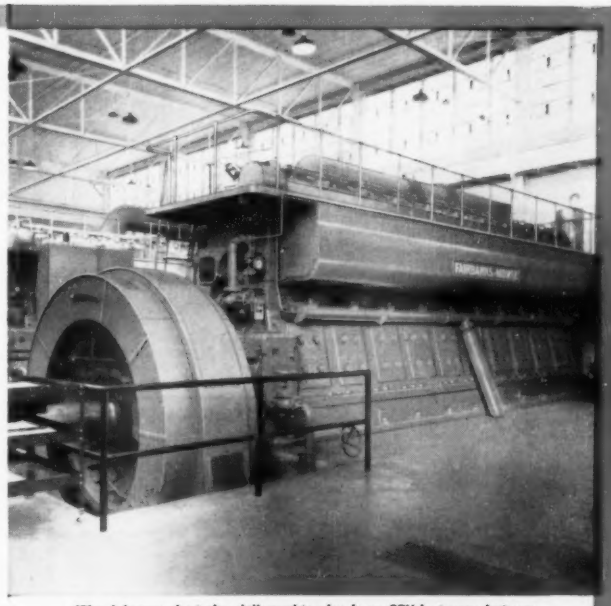
Outstanding Single Engine Performance

Engine No. 6 is one of three Fairbanks-Morse Model 31A 3500 horsepower engines that have helped keep the Johnson plant tops in efficiency for four years*. In winning previously, this engine set a record of 9213 BTU per kw-h—still unsurpassed by any engine today.

That winning record automatically selected the big No. 6 for the heaviest assignment to straight oil operation this year when gas supplies became short. *Yet*, the engine achieved an average of 9642 BTU per kw-h (Better than plant average) and during one period of operation maintained, an average of 8652.

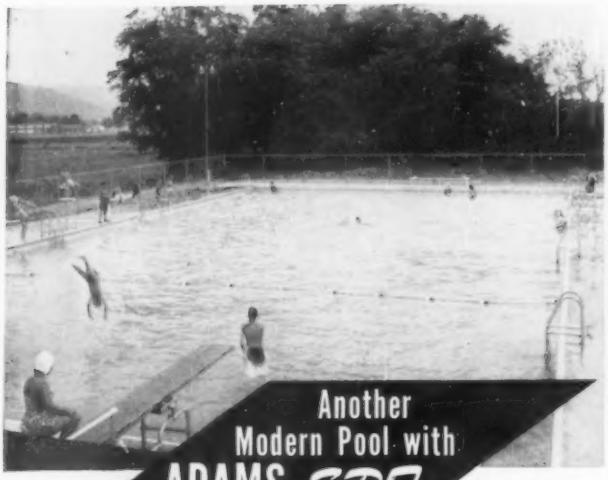
That's approximately 40% thermal efficiency!

Under all conditions of load . . . penalties of straight oil operation . . . two high-altitude plant locations—close scrutiny of performance records of this year's winning plants clearly establishes the fact—you can't make a better buy than a Fairbanks-Morse Diesel or Dual Fuel Engine. Fairbanks, Morse & Co., Chicago 5, Ill.



*The Johnson plant also delivered top kw-h per BTU last year, but was eliminated from competition due to winning in two previous years

Thousands use our Readers' Service card to keep up to date . . . do you?



Another Modern Pool with ADAMS SPF FILTERS

For maximum water clarity, the specifications for this new pool, Horseheads, N. Y., called for R. P. Adams Poro-Stone Filters.

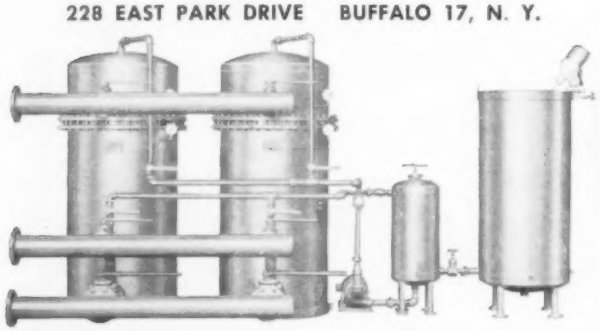
Yes, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4¼" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the handy coupon below.

R. P. ADAMS CO., INC.
228 EAST PARK DRIVE BUFFALO 17, N. Y.



The Double SPF-129 Poro-Stone filter shown above provides 258 square feet of filter area . . . will handle pools of 371,500 gallons capacity at 774 gallons per minute recirculation flow. It is ideal for outdoor pools such as the 268,000 gallon Horseheads pool.

R. P. ADAMS COMPANY, INC. JU-55
228 EAST PARK DRIVE, BUFFALO 17, N.Y.

Please send me by return mail your new Bulletin 625.

Name..... Title.....
Business.....
Street.....
City..... State.....
Size of pool is..... gallons.

CUT MAINTENANCE COSTS WITH A HEAVY-DUTY BMB Mower

From the simplest to the toughest cutting jobs on highways, parks, waterways, airports, and all public grounds—BMB Rotary Cutters do the job. They hook up to almost any type tractor, and cut grass, weeds, heavy undergrowth, clumps, bunches — pulverize stubble. BMB Rotary Cutters are economical and rugged. Choose any model. They withstand hard use, and give long, efficient, trouble-free service under all conditions at real low cost.

Order Now for Summer Maintenance

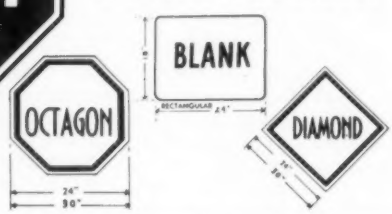
WRITE, WIRE OR PHONE
B·M·B Company, Inc.
319-21 NEW YORK AVENUE • HOLTON, KANSAS

CUT MAINTENANCE COST in HALF with GRACE "EZ-ON" TRAFFIC SIGN FACES:

'EZ-ON' Sign Faces—patented, are made of 30 ga. steel in 3 shapes and 3 sizes—octagon, diamond, rectangular—24" and 30" and 18" x 24". The former in red and yellow, the latter in white only. Standard copy or special—or the rectangular Face blank if you wish. They meet every need—at ½ the regular cost!

3 SHAPES . . . 3 SIZES!

'EZ-ON' Faces slip on right over your present signs—in less than 5 minutes—hence your signs are never out of service. Used by cities and Highway Dept's. all over the United States.



1. Slip 'EZ-ON' Face over old sign. Note wide flanges.
2. Then bend flanges backward holding 'EZ-ON' Face in place.
3. Use Crimping Tool to clamp flange and secure Sign Face.

GRACE 'EZ-ON' Sign Faces are reflectorized and meet all specifications for brilliance and reflective qualities. INVESTIGATE . . . and save. Their cost is HALF that of ordinary signs! SEND FOR SAMPLE SIGN. Dept. WP

GRACE SIGN & MFG. COMPANY
3605 S. SECOND ST. ST. LOUIS 18, MO.

Dustless roads for less money with COLUMBIA CALCIUM CHLORIDE!

- **please residents by stopping dust**
- **provide a smooth, durable surface**
- **conserve aggregates, cut costs**
- **reduce the number of bladings**

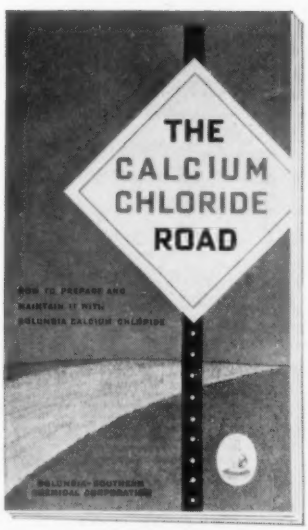
The all year performance and maintenance requirements of unpaved roads are largely dependent upon the conditioning and calcium chloride treatments made during the Spring.

Spring rains supply the moisture necessary for the efficient blading and shaping work. Late Spring application of calcium chloride insures best year-round performance. Natural road moisture is preserved to eliminate the formation of dust during the hot, dry summer months.

Spring conditioning of your unpaved roads pays big dividends throughout the year. Shape and crown your roads now, then treat with Columbia Calcium Chloride.

Order your supplies of Columbia Calcium Chloride today. Prompt delivery.

Address Calcium Chloride Dept. at our Pittsburgh address or any of the district offices.



Write now for your copy of this new 28-page booklet!

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FREE EQUIPMENT DATA to Help Your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

NEW LISTINGS

Handbook on Highway and Off-the-Road Tires

25. A 64-page illustrated handbook on highway and off-the-road tires has just been published by B. F. Goodrich Tire and Equipment Co., Akron, Ohio. It includes a tire selection chart and load and inflation tables, tire care and facts about tubeless tires and nylon construction. Check the reply card for your handbook.

Catalog on Tractor Maintenance

56. Entitled "Let's Talk Tractors", this catalog features the Caterpillar D6, D4 and D2 tractors and included are such topics as how to cut operating costs, how to prevent down time and how to keep machinery young. For your copy check the reply card or write Caterpillar Tractor Co., Peoria, Ill., for form No. 31921.

Complete Catalog on Traffic and Street Name Signs

57. Every sign for any city or county is illustrated and coded in this catalog as well as suggestions in regard to ordering special signs. A section devoted to off street parking lot signs is also included in this literature available from U. S. Porcelain Enamel Co., 4635 E. 52nd Drive, Los Angeles, Calif., or by checking the handy reply card today.

MORE LISTINGS ON PAGES 34 TO 50

Wire Rope For All Types of Construction

125. An information-packed 24-page bulletin on wire rope recommendations has just been issued by the Hazard Wire Rope Div., American Chain & Cable Co., Inc., Wilkes-Barre, Pa. Covering more than 120 different types of wire ropes used in construction, and such points as rope diameters, preforming, lay, grade and core are fully covered. Check the reply card.

Completely New Underwater Pumps

144. A comprehensive catalog on a complete line of submersible pumps has just been released by Lancaster Pump and Mfg. Co., Inc., Lancaster, Pa. These pumps are available from 1/3 to 360 hp with capacities up to 8000 gpm and are ideally suited for city water systems and irrigation installations. Check the reply card for your copy.

Conveyor Sludge Collector Specifications

210. A new bulletin showing the specifications and components of the type ME Conveyor Sludge Collector is available from Chain Belt Co., Dept. PR, Milwaukee 1, Wisc. Advantages of the collector and photos and line drawings are included. Check the handy reply card for bulletin # 315-62.

Safti-Design Hi-Way Rotary Mower

454. A rotary mower that mows a full 60-inch swath and has the exclusive safti-design is described in catalog available from Sunflower Industries, Inc., Olathe, Kansas. Complete specifications on this mower and other information can be had by checking the handy reply card.

Multicell Reduces Backwash Flow Rate in Filters

199. A three color bulletin #5624, entitled "Multicell Filters", is well illustrated and gives complete information on this efficient filter and "Multi-Plate" baffle underdrain for water treatment. This bulletin is available from General Filter Co., 925 Second St., Ames, Iowa, or by checking the reply card.

Lab Supplies For Water and Sewage Plants

276. Chemicals, solutions, apparatus, instruments, glass ware and test assemblies are a few of the items covered in catalog available from General Laboratory Supply Co., P. O. Box 2607, Paterson, N. J. Check the reply card for your catalog on laboratory supplies.

Amvit Mechanical Jointed Clay Pipe

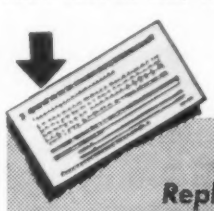
298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built-in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Controlled Closing Air Valve

319. A new concept for the protection of pipe lines against the damaging effects of surge and built-up pressures on water hammer, is graphically illustrated in bulletin No. 200 issued by the Simplex Valve & Meter Co., Lancaster, Pa. This new device can control the speed of line closure, vent air and discharge water. For full information check the reply card.

Modern Incineration For Municipalities

452. Information on incinerators for refuse, general rubbish and garbage is fully covered in literature available from American Incinerator Corp., 5710 E. Nevada, Detroit 34, Mich. Selection, application, design, advantages and operation are a few of the sections included. Check the handy reply card today.



Use the Reply Cards Inside Front Cover

The Ideal Rotary Cutter For Highway Mowing

381. Specifications and features of the B-M-B rotary cutter are fully described in literature available from B-M-B Co., Inc., 319-21 New York Ave., Holton, Kansas. Can be used for highways, airports, waterways and industrial plants. Check the reply card for information on this rugged, low price rotary cutter.

Literature on Recorders and Meters

424. Catalogs on range meters, temperature and pressure recorders, variable area flow instruments and electric flow meters are available from Penn Instruments Div., Burgess-Manning Co., 4110 Haverford Ave., Philadelphia 4, Pa. These catalogs are valuable for water and sewage plant operators and can be had by checking the reply card.

General Electric Bulletin on Turnpike and Expressway Lighting

445. A new 28-page bulletin dealing exclusively with the lighting of turnpikes and expressways is now available from the General Electric Co., Schenectady 5, N. Y. The publication, designated GED-3001, has separate sections on the lighting of toll plazas, interchanges, service areas, main traffic lanes, bridges, tunnels and viaducts. Check the reply card today.

Stressteel Wedge Tensioning Units in Prestressed Concrete

446. Information on STRESSTEEL wedge tensioning units and their application in prestressed concrete is available from Truscon Steel Div., Republic Steel, Youngstown, Ohio. Advantages, materials, wedge anchorage components, tests and specifications are fully described. Check the reply card for your copy of manual No. G-120.

Specification & Application Data for Traffic & Maintenance Paint

447. Specification data covering traffic and maintenance paints are covered in detail in the new "Specification Guide" being issued by the Sherwin-Williams Co., 101 Prospect Ave., Cleveland 1, Ohio. The data presented covers both white and yellow reflectorized and non-reflectorized traffic paints. Check the reply card for your copy of the guide.

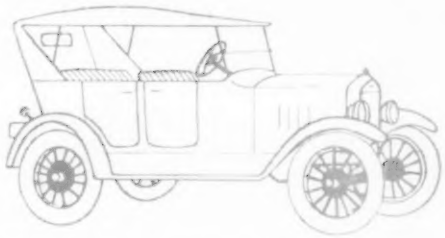
Monotube Overhead Sign Supports

433. Monotube overhead sign supports that aid traffic flow and safety on highways, freeways, turnpikes and expressway interchanges are explained fully in Catalog No. 88 just released by the Union Metal Mfg. Co., Canton 5, Ohio. Check the handy reply card for information on these new type steel supports.

Complete Line of Clay Construction Materials

234. A completely illustrated and comprehensive catalog describing their complete line of clay construction materials, is being distributed jointly by Cannelton Sewer Pipe Co., Cannelton, Ind., and the Texas Vitrified Pipe Co., Mineral Wells, Tex. It describes clay pipe, filter blocks, fire brick, clay wall coping and all types of construction of clay products. Check the reply card today.

light cars
of this vintage
advanced to 4-wheel brakes
more than a
quarter century ago . . .



. . . Yet of all street sweepers today — machines intended to transport heavy loads of debris —

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Get full details of this month's products . . . mail your Reader's Service card today.

Pressure Pipe Installation Guide

237. A new 108-page instruction manual just issued by Johns-Manville, 22 East 40th St., New York 16, N. Y., is planned for on-the-job use at the trench site. The instructions take up every step from receiving the pipe at the job to testing the finished installations. Check the reply card today.

Financing Water and Sewage Works

188. A new 24-page booklet to aid municipalities in planning and financing water and sewage projects is offered by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill. The booklet points out the need for adequate sanitation facilities, discusses methods of financing and factors to be considered in determining fair rate schedules for water and sewage services. Check the reply card.

Use a "Manhole Adapter" in Street Resurfacing

181. Literature is available from A. Reed Wilson Co., Kansas City 6, Mo. on a "Manhole Adapter" that permits no traffic tie-ups when you resurface streets. This easy-to-install, safe and economical adapter ring fits on any standard manhole. Check the reply card for complete information on this adapter.

Information on "Single-Pass" Soil Stabilizers

313. Soil-cement widening of highway pavements can be accomplished with the P & H soil stabilizers. Literature is available from P & H Soil Stabilizer Division, Harnischfeger Corp., Milwaukee 46, Wisc., or by checking the handy reply card.

Slide Rule PS1 Calculator For Concrete

334. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi. Give company name and title and check the reply card.

Concrete or Asphalt Saw

458. Concrete saws that sail right through concrete or asphalt are described fully in literature available from Clipper Manufacturing Co., 2804 S. Warwick, Kansas City 8, Mo. Also diamond and green-con blades are fully covered. Check the reply card.

WATER WORKS

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches. Check the reply card.

Elevated Tanks and Other Storage Facilities

32. How engineers' designs and standard AWWA specifications are followed for fabrication and erection of water storage facilities are described in color illustrated booklet. Address the Darby Corp., Kansas City, Kans., or use the handy reply card.

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes. Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A. Chicago 80, Ill. Check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Helpful Reference on Swimming Pool Equipment

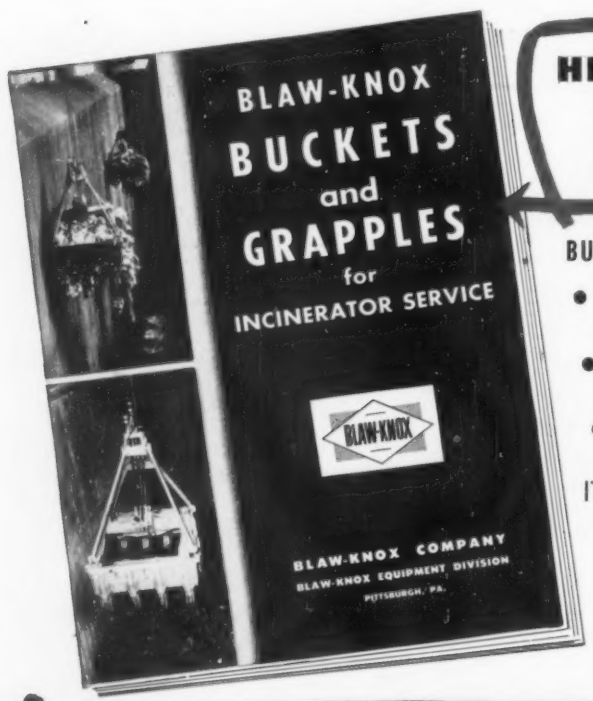
87. A complete reference catalog of swimming pool supplies, chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Helpful Booklet on Carryable Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Requirements are outlined for many applications. Just check the reply card for your copy. Homelite Div. of Textron American, Inc., 2125 Riverdale Ave., Port Chester, N. Y.



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every municipal and design engineer needs, when planning a modern incinerator

BULLETIN 2350-R ANSWERS IMPORTANT QUESTIONS

- What clearances (headroom) should you specify for tine type grapples or clamshell type buckets?
- Do you allow *extra* headroom over hoppers for the refuse that hangs below the bottom of the bucket?
- How can you be sure of getting the most economical bucket for your needs?

IT ALSO INCLUDES TYPICAL SPECIFICATIONS

for your guidance in selecting the proper clamshell type bucket or tine type grapple. Write for Bulletin 2350-R today.

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THE LOW-COST MOTOR GRADER THAT OFFERS more of everything...

more PRODUCTION-BOOSTING FEATURES

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GASOLINE — 50 brake hp. Bare grader weight —8,800 lb. Four forward speeds to 25.6 mph, one reverse to 3.3 mph.

DIESEL — 50 brake hp. Bare grader weight — 9,350 lb. Four forward speeds to 25.2 mph, one reverse to 3.2 mph.

ROLL-AWAY moldboard rolls the load instead of pushing it, moves more dirt, uses less power.

Plus one-piece tubular frame, tandem drive, real operator comfort, hydraulic blade lift.

USEFUL OPTIONAL FEATURES

Power circle turn for faster, easier, better control of blade . . . turns 135 degrees.

Leaning front wheels with heavy-duty axle, for better control in close quarter-work.

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Shoulder maintainer for safe, one-pass operation. Also available: one-pass windrow eliminator.

Rear-mounted 5/8-yd loader for fast, low-cost handling of materials.

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Need more facts about advertised products? Mail your Readers' Service card now.

To order these helpful booklets check the reply card inside front cover.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Easily Cleaned, Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

Purification of Swimming Pool Water

153. An up-to-date 64-page manual on purification of swimming pool waters presents a comprehensive discussion of daily requirements, chlorine residuals and feeding methods for hypochlorites and HTH tablets. Available from Industrial Chemicals Div., Olin Mathieson Chemical Corp., Baltimore 3, Md. by checking the reply card.

Semi-Automatic and Step Control Chlorine Feeding

160. A bulletin, complete with photographs and typical installation and control arrangement diagrams has been released by Builders-Providence, Inc., Providence, R. I. Applications of semi-automatic and step control chlorine feeding are discussed and the main advantages are included. For your copy check the reply card.

Data Offered on Elevated Steel Tanks

166. Attractive designs for elevated steel water storage tanks are shown in bulletins of R. D. Cole Mfg. Co., Newnan, Georgia. For copies of latest Cole literature check the reply card.

Engineering Data On Gravity Filter Design

170. The complete line of gravity filters and related accessories furnished by the Permutit Co., New York 36, N. Y., is covered in a well-illustrated 24-page booklet. Each element of a filter and filter controls are discussed in detail to assist the designer of these important units. Get your copy of this helpful publication by checking the reply card.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the reply card or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5403 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the reply card for your copy.

What You Should Know About Turbine Pumps

167. In a colorful bulletin titled "Water Where You Want It . . . When You Want It" the Johnston Pump Co., Bin "K", Pasadena 8, Calif., gives details on turbine pumps with semi-open or closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of Bulletin 1015 by checking the reply card.

What You Should Know About The Centriline Process

197. The Centriline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered. Check reply card for your copy.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the reply card.

Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet "Horton Elevated Steel Tanks of Large Capacity," Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspheroidal tanks of 1,000,000 to 3,000,000 gal. is included in this really handsome bulletin. Check reply card for your copy.

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Chemical weed and brush control pays off anywhere, but especially in hard-to-cut places like this. One spraying not only improves the appearance but saves hundreds of man-hours.

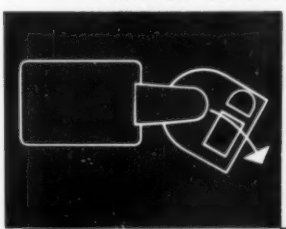
Whatever your weed and brush control requirements, DIAMOND has the information and the solution. As one of the world's largest makers of herbicides, DIAMOND has the experience and the facilities to help you select the right chemical formulation for the job. For information, write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, O.

DIAMOND CHEMICALS

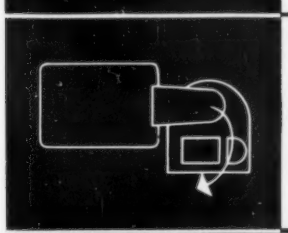
Diamond Chemicals

The new 7 to 20 ton SEAMAN-ANDWALL Pneumatic Compactor. Wheelbase 132". Overall length 211". Rolling width 90". Ground clearance 11". Overall height 71".

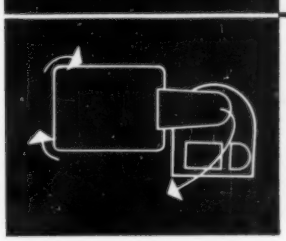
HOW THE 7-20 TON COMPACTOR TURNS 180° ON A 21 FT. ROAD



Powered front roller section starts turn. Rear section has not moved. Operator sits sideways, has excellent visibility.



Front section is now at 90°. Up to this point rear section still has not moved.



At this stage of the turn right rollers revolve backward, left rear rollers forward. All rear wheels are free-running, front rolls governed by friction clutches to eliminate scuffing.

KEEP THE JOB ROLLING *fast!*

There's news for you in the new — entirely new SEAMAN-ANDWALL 7 to 20 Ton Pneumatic Compactor:

NO SCUFFING — NO SURFACE SHEAR — NO MATERIAL DISPLACEMENT

That's because power is applied only to the front rolls to provide "straight down" pressure at all times — the only correct compaction principle.

THE JOB IS COMPLETED FASTER — 6 speeds forward from 1.5 to 20 mph; 2 speeds reverse 2 to 9 mph. And the Compactor is the most maneuverable of all the heavyweights . . . turns a full 180° in a 21 foot road.

HIGHER OPERATOR VISIBILITY: the driver sits sideways to forward travel, sees the work he's done and the work ahead.

POWER STEERING relieves operator fatigue, increases flexibility.

SELF-PROPELLED, the Compactor moves quickly from job to job under its own power.

A COMPLETELY NEW DESIGN with unusually low center of gravity so the compactor stays right side up and provides maximum compaction under all conditions.

ELECTRIC BRAKES, HEADLIGHTS and Sprinkler System complete the perfect picture.

Check with your SEAMAN-ANDWALL Distributor. Arrange for a demonstration.

New Bulletin completely describes SEAMAN-ANDWALL 7-20 ton Pneumatic Compactor. Send a postcard today. Ask for Bulletin PC-456.

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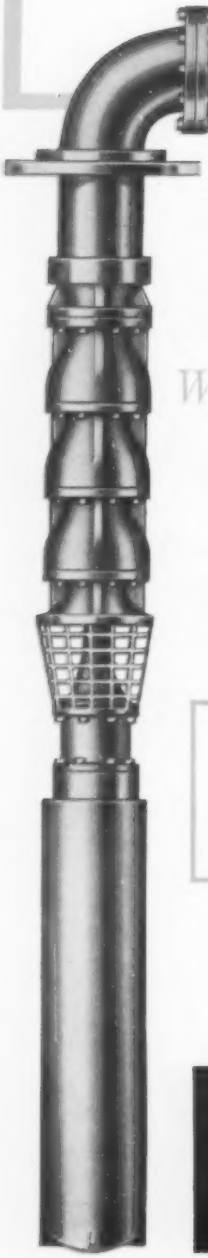
Verti-Line *Submersible*

BOOSTER PUMPS



Layne & Bowler's half-a-century of experience in the design, engineering and manufacturing of vertical pumps, and the know-how of General Electric in the electric motor field *are now joined to produce the most advanced Submersible Booster Pumps made.* Sizes from 5 to 125 H.P.

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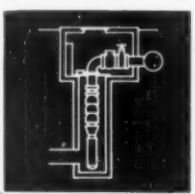
For maintenance-free performance, without adjustment or lubrication!

Some typical applications

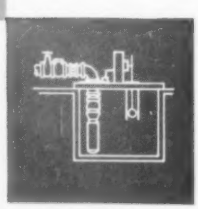
pumping directly into distribution mains



fire protection

sump operation

cooling tower service



Send today for new bulletin containing description of pump and motor features, material specifications, selection tables and application data. Ask for bulletin U-66.

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Get full details of this month's products . . . mail your Reader's Service card today.

Valuable Information on Water And Waste Treatment Instrumentation

229. Helpful data on pneumatic instrumentation, flow measurement, recording controllers and rapid sand filter control systems are included in a 16-page Bulletin 1-15. Get this from the Foxboro Co., Foxboro, Mass, or by checking the handy reply card.

Explaining the Water Diaphragm Principle of Chlorinator Operation

243. The features, operation and benefits of the water diaphragm principle of chlorinator operation are fully described and illustrated in Publication TA-1026-C-1 of Wallace & Tiernan Inc., Belleville 9, N. J. This helpful publication is yours for merely checking the reply card.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the reply card.

Valuable Chlorinator Catalog

300. A chlorinator for purifying water supplies, treating sewage and industrial wastes and for control of slime is illustrated and described in Catalog 70-10 just released by Fischer & Porter Company, 539 Jacksonville Road, Hatboro, Pa. A multi-colored flow diagram showing how chlorine gas and water are kept separate until they reach the ejector system is included. For full details check the reply card.

For Prompt Service Use The Reply Card

Engineering Data on Pneumatic Ejectors

327. Advantages of Shone Ejectors with details on receivers, check valves, pilot valves, installation and important operation and maintenance features are fully described in three new catalogs covering mechanically controlled types, electrode controlled units and the Expelsor pneumatic ejector. Write Yeomans Brothers Co., 2000-1 N. Ruby St., Melrose Park, Ill., or check the reply card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wis. Check the reply card. for your copy.

Points to Consider in Filter Sand Selection

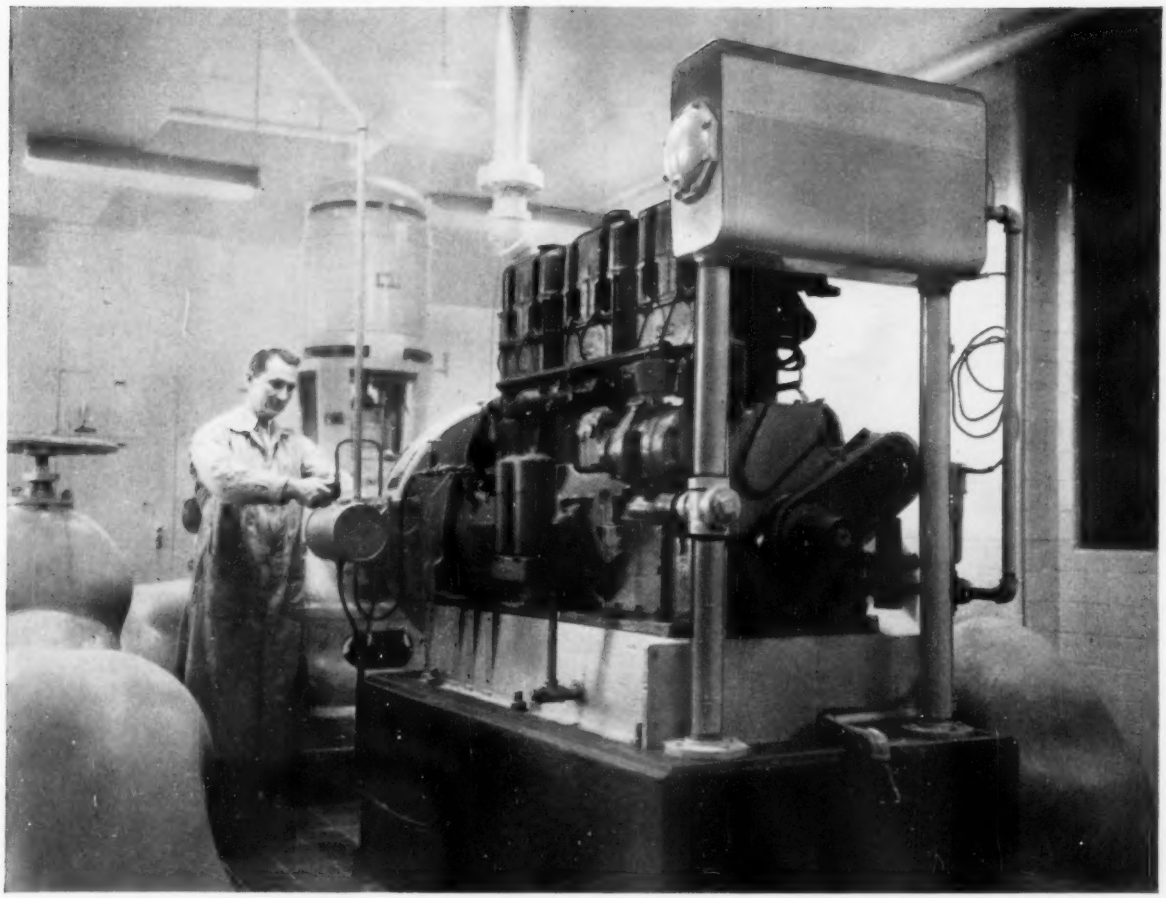
332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the reply card.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 488 Madison Ave., New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the reply card for your request.

Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 1246 from Norton Co., Worcester 6, Mass. by checking the reply card.



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That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over $4000 a year for 14 years — others that have saved $7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 655 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

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Reference Data on the Electric Check Valve

344. Comprehensive data on the Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the reply card for Bulletin W-10.

Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 225 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the reply card for your copy of this helpful bulletin.

Valuable Information On Prestressed Concrete Tanks

356. This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 211 East 37th St., New York 16, N. Y., or check the reply card.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use reply card or write to Fairbanks, Morse & Co., Dept. P. W., Chicago 5, Ill.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. or check the reply card.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind. Check reply card for your copy.

Simple Culvert End Finishes With CMP

393. A new illustrated bulletin from Armco Drainage & Metal Products, Inc., Middletown, Ohio, tells how to achieve a wide variety of end finishes with corrugated metal pipe installations. Among these are end sections, square, beveled and skewed ends, riprap, sheeting and drop inlet. Check the reply card today for your copy.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the reply card.

How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs. Check reply card for your copies.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwaukee 14, Wis. Detailed specifications are included. Check the reply card for your copy.

Catalogs on Horizontal and Industrial Service Pumps

477. Pump capacities, heads and horsepowers are fully described in Catalogs B-505 and B-1300 available from Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif. For this information on how these horizontal and industrial service pumps can help, you check the reply card.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Packaged Sewage Treatment— Just Right for Small Places

36. "Pakage" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., Dept. J, 622 Diversey Pkwy., Chicago 14, Ill., or check the reply card.

How to raise sunken curbs gutters driveways sidewalks street slabs

KOEHRING MUD-JACK® pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water, or water-saturated materials — raises the concrete slab — leaves solid, permanent sub-grade. How else could you do it? *Only with a Koehring Mud-Jack.* Two sizes: compact, portable No. 10 for city work (illustrated) — and big No. 50 for preventive maintenance and low-cost repairs on highways.

Write to: **KOEHRING CO.**, Milwaukee 16, Wis. for Mud-Jack Bulletin.

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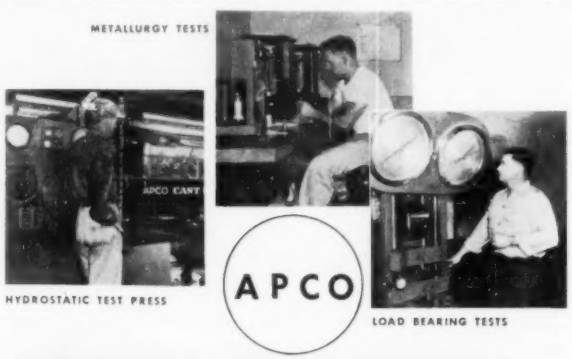
METALLURGY TESTS



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Set your sights on an Allis-Chalmers HD-6G

"Our new HD-6G saves man-hours and speeds road construction."

Clyde Kilpatrick, Supervisor
District 2, Newton County, Mississippi

Versatility counts on county jobs. And in Newton County they're proving it with a new HD-6G tractor shovel. In its first two months on the job, the 6G dug pipe-line ditches, laid concrete pipe, cleared right-of-way and cut drainage ditches. The 6G also loaded sand and gravel on a State Aid road project.

On this job, it loaded a truck every three minutes, nine hours a day. No wonder Supervisor Kilpatrick says: "Our HD-6G does everything more specialized equipment can do." With its 1½-yd bucket and many interchangeable attachments, it stays busy—and busy equipment stretches budget dollars. And—as Mr. Kilpatrick says: "We're always sure of good service from our Allis-Chalmers dealer."

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Yes, cost-conscious counties and townships get their budget's worth from the useful HD-6G. When you want equipment to lend a hand on out-of-the-ordinary jobs, you can count on the 6G. And here's why—the HD-6G represents the *most* advanced engineering in the tractor shovel business—not just in features but in *basic* design. That means plenty of *power*, superior *balance*, extra *strength* in all components, *weight* in the working parts and big safety factors . . . plus many exclusive on-the-job advantages important to owners and operators.

HD-6G tractor shovels are working in your area now. Check your Allis-Chalmers construction machinery dealer on where you can see one in action. And remember, your dealer is headquarters for factory-trained servicemen, factory-approved facilities and complete stocks of True Original Parts to keep your equipment operating right. See him soon.

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1½-yd bucket
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19,600 lb

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It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

To order these helpful booklets check the reply card inside front cover.

Removing Grit From Sewage and Trade Wastes

80. The 20-page bulletin on the modern method for removing grit published by The Dorr-Oliver Company, Barry Place, Stamford, Conn., provides detailed description of the design and operation of The Dorr Detritor. Pertinent facts concerning the types, special designs, advantages, principle of design are included. Check the reply card for your copy of Bulletin #6411.

Engineering Data on the Spiraflo Clarifier

124. Be sure to investigate the advantages of the Spiraflo clarifier for sewage treatment. Full engineering data, description of the unit, test results and specifications are offered in 24-page Bulletin 122 by Lakeside Engineering Corp., 222 W. Adams St., Chicago, Ill. Check the reply card today.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking the reply card.

How and Where to Install A Septic Tank System

270. A manual on modern sewage disposal methods for individual dwellings, camps and rural schools has just been released by Brown Co., 150 Causeway St., Boston, Mass. Location, size of and building the tank, how large a disposal field and laying out the field are discussed. Check the reply card today.

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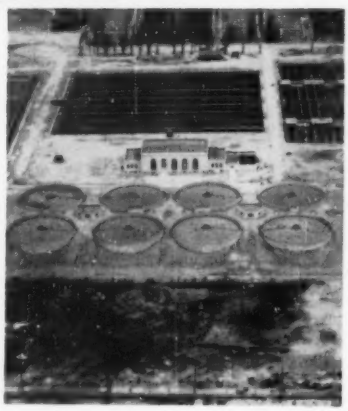

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A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the reply card for your copy of this helpful handbook.

What You Should Know About Filter Plant Gauges

156. Helpful data on filter plant gauges and the various types of meters used for filter plant operation are presented in a comprehensive 20-page booklet offered by Simplex Valve and Meter Co., 7 E. Orange St., Lancaster, Pa. A wealth of general information plus specifications and other pertinent data are included. To get your copy of this bulletin, No. 1002, check the reply card.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflow" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317 B-12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J. Just use the reply card.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833-A. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use reply card or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 427 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineers in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the reply card.

Get the Facts on The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the reply card to get the facts.

Flexible Coupling Speeds Vitrified Pipe Installation

311. Fast pipe laying with chemically inert, leakproof joints is made easy by Universal vitrified pipe with Tylox rubber joints. Full information on these materials and pipe laying methods is available from Universal Sewer Pepe Corp., 1500 Union Commerce Bldg., Cleveland 14, Ohio. Check the reply card.

Engineering Data on Gas Safety Equipment

342. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

What You Should Know About the Rubber Waterstop

448. A bulletin on the Servicised rubber waterstop has been released by Servicised Products Corp., 6051 West 65th St., Chicago 38, Ill. General information, engineering service, advantages of specifying the waterstop, specifications, general and detail requirements, installation and typical applications, standard sizes and types are fully covered. Check the reply card for your copy.

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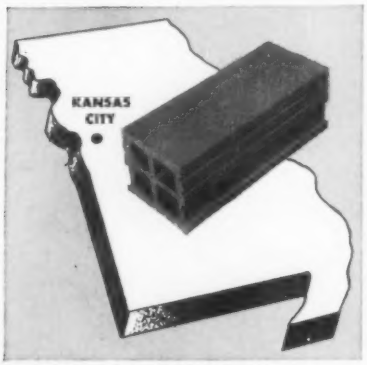

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198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit Netco Div., Clarke-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Does Your Water Works Have Standby Power?

224. Climax Engines are used in Municipal Water Works to supply dependable power during emergencies. They are available in a range of sizes from 40 to 600 HP and operate on either natural gas, butane, gasoline or a combination of these fuels. Use the handy reply card to obtain complete details and literature from Climax Engine & Pump Co., 208 S. La Salle St., Chicago 4, Illinois.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. PW., 2413 W. Carlson St., Pittsburgh 4, Pa.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the reply card for your copy.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Get latest data by checking the reply card.

●

CONSTRUCTION EQUIPMENT AND MATERIALS

Uses and Erection Data of Barrier Beam Guard Rail

46. Typical installations, erection instructions, specifications, curving data and physical properties of the barrier beam guard rail are fully covered in the catalog available from United Steel Fabricators, Inc., Wooster, Ohio. Plenty of photographs and drawings are included. Check the reply card.

A Gasoline Engine For Many Municipal Jobs

161. Catalog on a power packed 2-cycle gasoline engine that is designed to do many municipal jobs is available from Mall Tool Co., 7752 South Chicago Ave., Chicago 19, Ill. Information on how this lightweight maneuverable engine can power a dozen attachments is included. Check the reply card.

Highway Engineers' Information On An Aggregate and Material Dryer

172. This bulletin contains specifications, illustrations and design of the "Tarco" sand, stone and gravel dryer. Heating and drying capacity, attachments and modifications are covered. Get your copy from Tarrant Mfg. Co., Saratoga Springs, N. Y., or check the reply card.

Cut Road Building Costs With A Tamping-Leveling-Finisher

175. For a full description of roadbuilding methods with a tamping-leveling-finisher which lays a smooth mat without forms, tamping and compacting to desired grade, get Bulletin 879-A from Barber-Greene Co., Aurora, Ill. Check the reply card today.

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use reply card for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman-Andwall Corp., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check reply card for copy.

Complete Protection Of Iron and Steel Products

242. What are the advantages of Hot-Dip Galvanizing? Why does it offer complete protection at such an economical cost? You'll find the answers in the attractive booklet "Stop Rust", which gives you the full story of the process plus a comprehensive coating comparison chart. Get your copy promptly by checking the reply card or write American Hot-Dip Galvanizers Assn., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

"A Complete Package" of Road Building Equipment

261. A new catalog describing the road widener, trench roller and base paver has been released by Blaw-Knox Co., Construction Equipment Division, Pittsburgh 38, Pa. Illustrations, specifications and operation procedures are fully covered. Check the reply card today.

Give Full Protection To Treated Poles and Timbers

267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Write Greenlee Bros. & Co., Rockford, Ill., or check the reply card.

Booklet Helps Design of Custom-Engineered Steel Buildings

271. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the reply card or write to Butler Mfg. Co., Kansas City, Mo.

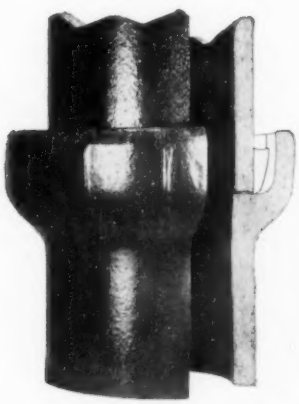
Davis Back-Hoe and Davis Loader

312. Literature is available from Mid-Western Industries, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis back-hoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors. Check the handy reply card for more information.

What Equipment is Needed By Modern Community Services

328. The importance of modern equipment in work programs is graphically illustrated in the 16-page booklet "Allis-Chalmers Offers New Economy for Villages, Townships, Counties, Cities, States, Federal." Action photographs span the range of community projects and illustrate tractors, scrapers, graders, power units and their multi-purpose attachments. Get this handsome booklet and review your needs today. Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee 1, Wis. Check the reply card.

AMVIT* JOINTED CLAY PIPE gains wide acceptance, more than 60 major installations completed in 1955



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Field tests from these installations show that ground water infiltration can be controlled and prevented—thus reducing pumping and treatment plant costs.
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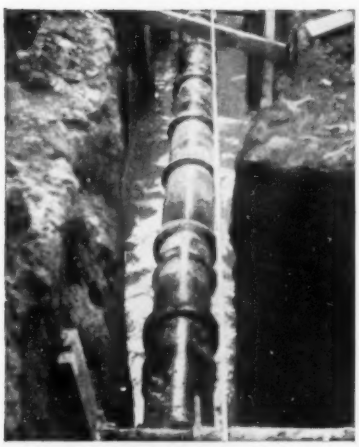
Since no other material such as caulking, joint compound, hot-pots or ladles are needed to make the Amvit Joint, installation is quick and easy. The joint is on the pipe delivered to the job ready to use. Savings with Amvit Jointed Clay Pipe mean *lower cost of pipe in place* when the line must meet a rigid test.

Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings is available for immediate delivery in the Northeast and Central States.

For more information, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.



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To order these helpful booklets check the reply card inside front cover.

Portable Melting Furnace For Rubberized Joint Sealers

357. The Hauck double jacketed melting furnaces use L-P as a fuel and a high flash point oil for heat transfer to assure close temperature control when melting rubberized joint sealers of all types. All details on this 16-gallon capacity unit are furnished in Bulletin 1081. Check reply card for your copy. Hauck Mfg. Co., 124 10th St., Brooklyn 15, N. Y.

Better Drainage for Streets and Highways

358. Irving "Dryway" Draingrates provide maximum drainage openings for catch basin inlets, across-the-road drains and center-line drains. Light weight, strength, economy and corrosion resistance are a few of the many features offered. Full descriptive details on both riveted and pressure locked type are furnished in an illustrated bulletin by Irving Subway Grating Co., Inc., 50-53 27th St., Long Island City 1, N. Y. Check the reply card.

For Prompt Service Use
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Inside Front Cover

"Water Boy" Portable Water Coolers

432. Descriptive literature is available on portable water coolers and cans with the Sparkleen Liner. Sizes, models and price lists are fully covered in bulletins from Schlueter Mfg. Co., 4616 N. Broadway, St. Louis 7 Mo. Check the handy reply card.

Get Data on Automatic Engine Control Equipment

462. Automatic controls for engine starting and overspeed protection are described in the latest Synchro-Start literature. For full application data and specifications get Catalog No. 5 from Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Requests for this valuable literature must be made on business letterhead.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the reply card for your copy.

Convenient Data on Tandem and 3-Wheel Rollers

449. This manual covers everything on the variable weight, 5-8, 8-10, 8-12 and 10-14 ton tandem rollers and on the standard and variable weight, 8, 10, 12, 14 ton and 8-10, 10-12, 12-14 ton 3-wheel rollers. Covered are the frame, transmission, final drive, front end and operator's controls. The design, construction, performance and service of the rollers are fully outlined. There are plenty of illustrations along with a complete set of specifications for each roller model. Available from Huber-Warco Co., Marion, Ohio, or check the reply card.

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

Dust Control Made Easy

30. Details on an effective solution for your dust annoyance problems are presented in a colorful bulletin. "Gulf Sani-Soil-Set—the modern, proven agent for controlling dust." Get your copy to learn how this long-lasting, easily applied material can be of help. Write Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30, Pa. or check the reply card.

Better Highways Through Salt-Soil Stabilization

123. Shoulder stabilization is the subject of a new booklet in the series of informative pamphlets issued by International Salt Co., Inc., Scranton, Pa. Step-by-step illustrations show construction procedures in detail. For practical information on this important subject check the reply card today.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio. Use the reply card to get your copy.

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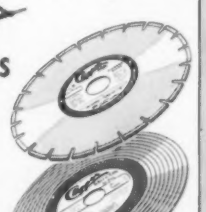

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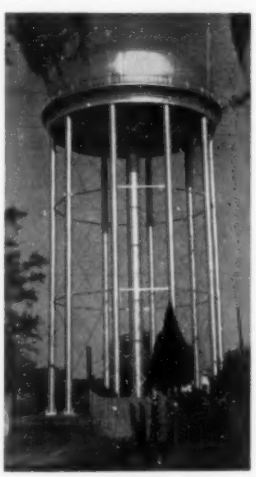

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1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy reply card for full data. Ernest Holmes Co., Chattanooga, Tenn.

Streamlined Data on Tractors, Scrapers and Power Units

102. The complete line of International Industrial Power products, 73 in all, is described in a new 48-page catalog published by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Technical data has been streamlined, yet provides abundant descriptive material on each piece of equipment. Check the reply card for the latest on crawler and wheel tractors, scrapers, dozers and related attachments plus International Diesel, gasoline and gas power units.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the reply card for your copy.

How the "Payloader" Helps Public Officials

190. An attractive booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the reply card or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

Advanced Tractor Design Gives Better Performance

399. The Ford Tractor offers 4-wheel stability, built-in hydraulic system, power take-off, as well as greater power, performance and economy. A complete booklet describes five tractor models in two power series, showing the latest in advanced tractor design and including many applications of equipment for saving time and money. For your copy check the reply card or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave. S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs. Check the reply card.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Full data on these ditchers available by checking the reply card.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 2530 N. Second St., Minneapolis 11, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

The Modern Approach to the Brush Problem

222. Eliminate your brush disposal problem by using an Asplundh Chipper. For complete information on what the Chipper can do, how it can save on costs, various types available and other outstanding features write to Asplundh Chipper Co., 505 York Road, Jenkintown, Pa., or check the reply card.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

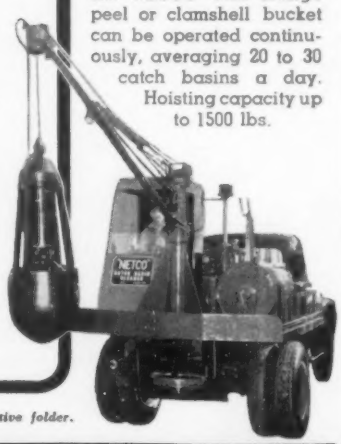
Literature Available on Wagner Tractor Equipment

464. Information on the Wagner back hoe and loader is available from Wagner Iron Works, Dept. 129, 1905 South First St., Milwaukee 1, Wisc. Specifications, types, models and other valuable data are included. For your copy check the reply card.

New NETCO Catch Basin Cleaners are Working Throughout the Land in These Cities

Chicago, Illinois
Indianapolis, Ind.
Cumberland, Md.
Boston, Mass.
Fitchburg, Mass.
Lowell, Mass.
Grand Rapids, Mich.
Trenton, N. J.
Westfield, N. J.
Binghamton, N. Y.
City of N. Y., N. Y.
Utica, N. Y.
Parma, Ohio
Philadelphia, Pa.
Pa. Turnpike Comm.
Hamilton, Toronto Canada

Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.



Send for our 6 page descriptive folder.

NETCO DIVISION
CLARK-WILCOX COMPANY
118 Western Avenue
Boston 34, Massachusetts

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ANTHRAFILT FILTER MEDIA

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

PALMER

FILTER BED AGITATORS

FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. • Erie, Pa.

What's Your Digging Problem?
Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

How to Prepare and Maintain
Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

Choosing Trucks
For Municipal Service

204. Trucks that are high in efficiency and economy are needed for all municipal services. Be sure to investigate latest models of White motor trucks, engineered for high performance under all conditions. Full details from White Motor Co., Cleveland 1, Ohio. Check the reply card today.

New Reflectorized Sign Faces
Refurbish Old Traffic Signs

292. Get complete details on new "EZ-On" traffic sign faces ready for immediate shipments. Reflectorized faces cost only a fraction as much as new signs and are easily attached to existing traffic signs. Use the reply card for data today. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Economical Scraper
Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal; and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the reply card.

Gar Wood Pipe
and Utility Ditcher

421. Literature is available on the Gar Wood-Buckeye 305 crawler trencher from the Customer Service Dept., Gar Wood Industries, Inc., Wayne, Mich. Line hydraulic wheel hoist and hydraulic conveyor drive are several features of the ditcher described in the bulletins. Check the reply card.

●

WEED AND INSECT CONTROL

Chemicals for
Non-Selective Weed Control

79. UREABOR weed and grass killer destroys vegetation about fence lines, parking lots, storage areas and similar places. Ease of application and long-lasting results make this material the choice where a nonselective herbicide is required. For latest data write Pacific Coast Borax Co., 630 Shatto Pl., Los Angeles 5, Calif. or check the reply card.

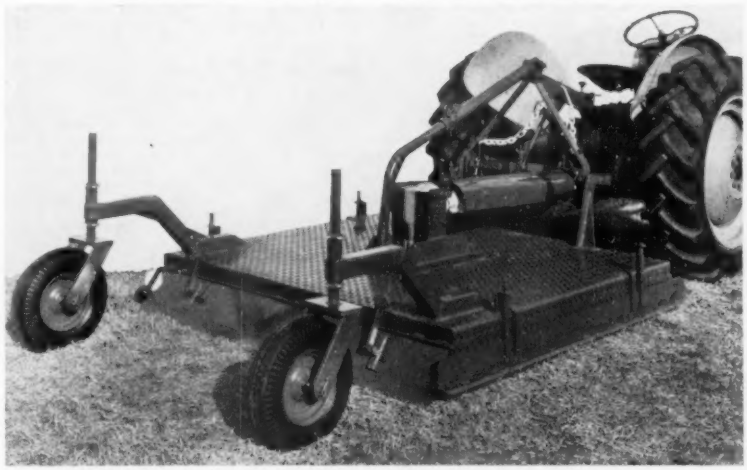
Weed Killing
Case Histories

205. Long term weed and grass control . . . costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the reply card for your copy.

How to Cut
Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

The Nation's SAFEST Highway & Public Park ROTARY MOWER!

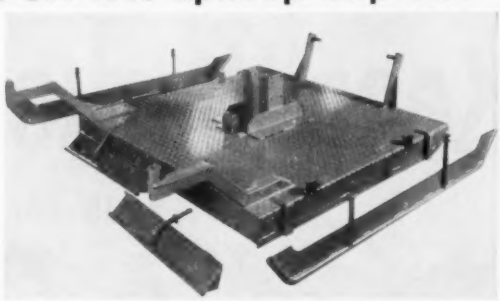


SUN-MASTR MS260 DeLuxe
Mow More Miles FASTER-SAFER and with MUCH less upkeep expense

EXCLUSIVE DESIGN
AUTOMATIC
SAFETY SHIELDS

Do Away with
Belts and Chains

OTHER IMPORTANT
EXCLUSIVE Features



Only SUN-MASTR MOWERS offer ALL These Advantages

EXTRA STURDY THROUGHOUT

Built to withstand rough treatment. Standard equipment includes H.D. 40 H.P. Borg-Warner Gear Box—Forged double-edge SPRING STEEL Blades mounted for gyral action—Blood Bros. Drive Shaft—4-Way Floor Plate Shield — H.D. Tires — Bearing equipped Wheels.

MODELS for ALL Tractors

Get Free ILLUSTRATED Catalog

Write or Phone

SUNFLOWER INDUSTRIES, Inc.
Olathe, Kansas

To order these helpful booklets check the reply card inside front cover.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Fluorescent Street Lighting For the Whole Community

128. Literature on the 5 new G-E fluorescent luminaires, each designed for a different area, is available from Section 452-166, General Electric Co., Schenectady 5, N. Y. Fluorescents for residential, secondary and primary traffic, main streets and whiteway areas are fully described. Features to simplify installation, lower maintenance and to give maximum performance are explained in drawings and photographs. Check the handy reply card today.

A New Development in Fluorescent Lighting

130. A catalog on LUXaire (R), a new development in outdoor fluorescent lighting, is offered by Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. The catalog illustrates actual installations, provides engineering information and suggests more than a dozen special applications. Check the reply card.

Safe-T-Cones Solve Traffic Problems Night and Day

136. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nighttime use—get bulletin from Radiator Specialty Co., Charlotte, N. C. Information included on Safe-T-Signs which add greatly to value of markers. Check the reply card.

Traffic System Computer & Selector

260. Electro-Matic Master Equipment is fully covered in Bulletin E-222 just released by Automatic Signal Div., Eastern Industries, Inc., Norwalk, Conn. This system provides coordinated signal control responsive to traffic changes as they develop and it continually evaluates and adjusts to volume and direction of traffic. Check the reply card.

Valuable Booklet on Series Streetlighting Systems

306. This booklet discusses the operating characteristics of mercury lamps on series street lighting systems and analyzer requirements for auxiliary equipment. Wiring diagrams and photographs to illustrate the principal equipment required for series operation are furnished. Booklet B-6513 is available from Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio, or by checking the reply card.

REFUSE COLLECTION AND DISPOSAL

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16, 20, 24 cu. yd. capacities. Get all the facts from M-B Corp., New Holstein, Wis.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 8, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

For Prompt Service Use The Reply Card

What You Should Know About Refuse Incinerators

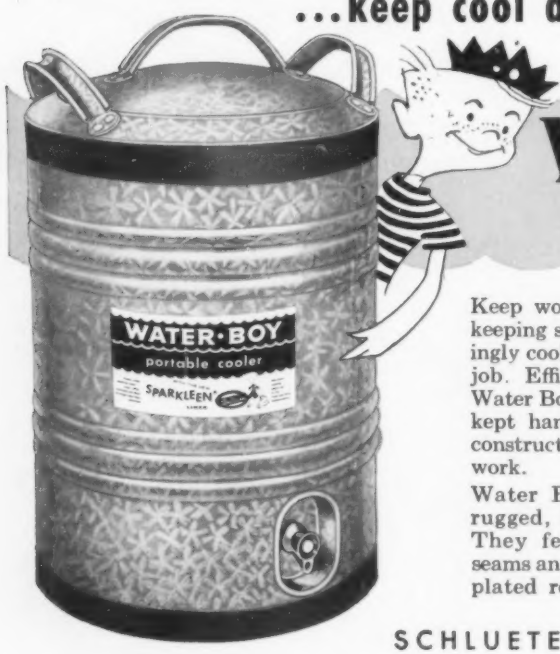
362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Check These Features On Refuse Collection Bodies

383. The Heil "Colectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Available in 16 and 20 cu. yd. capacities. Check them all by getting attractive Bulletin BH-54103 from The Heil Co., 3044 W. Montana St., Milwaukee 1, Wis. Your copy is ready—just check the reply card.

Keep Worker Efficiency Up!

...keep cool drinking water on the job with



WATER BOY portable water coolers

Keep workmen on the job by keeping sparkling pure, refreshingly cool drinking water on the job. Efficiency goes up when Water Boy Portable Coolers are kept handy on every type of construction and maintenance work.

Water Boy Coolers are big, rugged, built to take abuse. They feature double-locked seams and bottoms, brass-nickel plated recessed faucets, fully enclosed or open-rimmed covers. There's the new SPARKLEEN liner, too, that keeps water sparkling clean, odor-free and taste-free.

You'll find Water Boys are a money-saving investment everywhere they're used.

QUALITY HEAVY METALWARE DeLuxe SCHLUETER MFG. CO. ST. LOUIS, MO.

SCHLUETER MFG. CO., ST. LOUIS 7, MISSOURI

UNITED STATES CONCRETE PIPE...

★LENGTHENS LIFE ★REDUCES COST

of Concrete Waste Disposal Lines

PROJECT: Anacostia Trunk Sewer —Tuxedo District of Prince Georges' County, Maryland.

ENGINEERS: Whitman, Requardt & Associates, Baltimore, Maryland, for Washington Suburban Sanitary Commission, Hyattsville, Maryland.

CONTRACTOR: Intercounty Construction Corporation, Hyattsville, Maryland.

PIPE: Manufactured by United States Concrete Pipe Company — 72" Reinforced Concrete Culvert Pipe in 8' lengths.

JOINTS: TYLOX Type H Rubber Gaskets, manufactured by Hamilton Kent Manufacturing Co., Kent, Ohio.

In more and more sewerage and drainage jobs where concrete pipe is required, UNITED STATES Concrete Pipe is being supplied with TYLOX Rubber Gaskets. Typical of this trend is the project shown above. Rubber Gaskets were specified because it is known from experience how they help to cut cost, lengthen life and reduce maintenance of concrete sewers and drains.

Among many PLUS features which have helped earn confidence for our Pipe, three special advantages stand out . .

GREAT STRENGTH— exceeds A.S.T.M. and all other official specifications. It safely withstands shock, soil stresses, overburdens.

DENSE STRUCTURE— resists corrosion, tuberculation, electrolysis . . . provides greatest hydraulic efficiency.

LOW COST of installation, and in future operation and maintenance of the line.

If you are planning a job for concrete pipe, contact our nearest sales office for more details on Tylox-Jointed United States Concrete Pipe. Read the facts . . . then *specify* "UNITED STATES" to assure lower construction cost and longer life of *your* concrete pipe projects.

6003

PRODUCTS

Vitrified Pipe and Fittings, Concrete Pipe, Vitrified Liner Plates, Ship Lap Wall Coping and other Clay Products.

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UNITED STATES
CONCRETE PIPE COMPANY
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GENERAL OFFICES • 1500 Union Commerce Bldg. • Cleveland 14, Ohio • Tel. Main 1-5240

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For any Public Works Job . . .

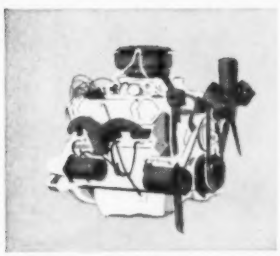
Only FORD TRUCKS give you all these money-saving features!

More power – plus a combination of long-life features no other truck engines offer!

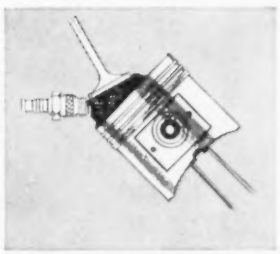
Lifeguard Design... exclusive safety features found in no other truck!

More load-carrying ability... more money-making capacity from the ground up!

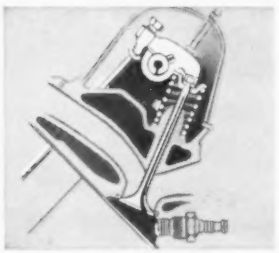
Now's the time to mail this month's Readers' Service card.



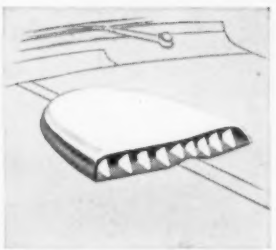
Now! Increased horsepower gets jobs done faster—with more efficiency. Only Ford Trucks offer modern Short Stroke power in every model—and at no extra cost!



New! The higher compression ratios give still finer performance with regular gasoline. Only Ford lets you choose from *seven* V-8's and a Six!



New "multi-mile" valve combination for heavy-duty engines, includes new sodium-cooled exhaust valves, new self-sealing dished-type intake valves.



New hood air scoop, 4-barrel carburetor, and dual exhaust system available on Series 750 and up, for extra reserve power. More pull on hills, safer passing!

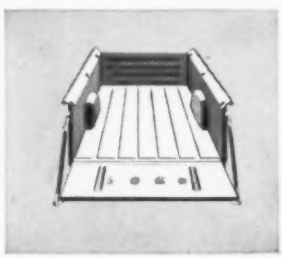
New deep-center Lifeguard steering wheel helps protect driver from contact with steering column in case of accident. *Only Ford Trucks have it!*

New Lifeguard door latches have double grip, give added protection against doors springing open in an accident. Only Ford Trucks have this safety feature!

New Ford seat belts greatly reduce your chances of getting seriously hurt in an accident, by holding you firmly in your seat. Available at low additional cost.

Biggest brakes in the ½-ton field! Ford light-duty models for '56 have new, thicker brake linings for up to 33% longer life. Power brakes, low added cost.

Now, payload increases up to one ton! Bigger payloads right down the line. New Ford T-800, for example, *hauls up to 3,000 lbs.* more than most 6-wheelers!



New! 8-ft. Pickup body, available on ½-ton Model F-100, has biggest loadspace of *any* half-tonner—65.4 cu. ft.! 6½-ft. Pickup box is standard. GVW 5,000 lbs.

New tubeless tires on every Ford model run 25° cooler, give extra mileage, resist punctures and blowouts. Standard at no extra cost!

FORD TRUCKS LAST LONGER

BIG FLEET OWNERS BUY MORE FORD CARS AND TRUCKS THAN ANY OTHER MAKE

Get full details of this month's products . . . mail your Reader's Service card today.

NEW Forward-Tipping BUCKET
BROADENS USE OF LOADER*

*PERMITS LOADING OF OTHER TRUCKS

New Feature Offers *BIG SAVINGS* In Material Handling!

Introduction of the New Forward Tipping Bucket opens-up an entirely new field of work for trucks equipped with a Holmes Owen Loader. Development of this new feature now makes it possible for the loader to be used as an independent working unit, capable of doing its own digging, loading and dumping; or, as loader for a fleet of dump trucks. The new type bucket is hydraulically operated by two double acting cylinders, mounted on the top side of each bucket arm. Through controls located on the steering column, the bucket may be easily rotated 120 degrees. This allows the operator to turn the digging edge down when necessary for loading, move the bucket forward or backward for dumping.

CUTS COST OF SOME JOBS—50%

Being able to eliminate the use of additional man power and equipment, on such jobs as; grading, loading, cleaning-up and even loading of other trucks — saves time, labor and equipment, which substantially reduces the cost of material handling. A truck with such versatile one-man operation can easily do the work of several men, and as such, becomes a valuable asset in reducing today's high cost of operation. The Holmes Owen LOADER is hydraulically operated, lifts ½ yard per bucket, loads the average truck in 4 minutes and can be installed on most 1½ to 2 ton trucks. See your Equipment Dealer or write today for literature and prices.

ERNEST HOLMES COMPANY
Chattanooga Tennessee

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the new Philadelphia story

. . . the story of what has happened to traffic on historic Broad Street

Traffic congestion—the plague that is paralyzing almost every city—had transportation clogged along the more than seven miles of Broad Street.

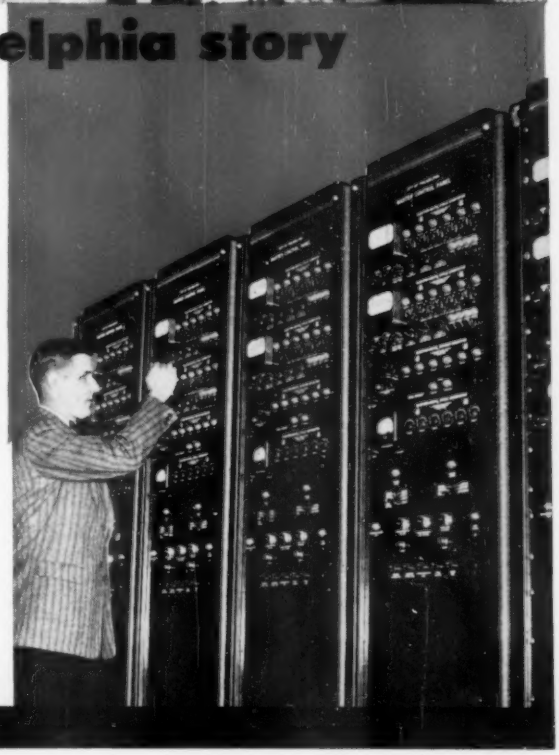
Imaginative traffic signal engineering and modern equipment were called on to give this famous thoroughfare new efficiency. Now, the signal light timing on Broad Street is automatically adjusted by changing traffic needs—all day, every day, as they occur.

Roadway treadles continuously monitor the cars moving in both directions on Broad Street. A Master Control compares flow and counter-flow, and establishes the time cycle and offset pattern of signal light operation to serve current traffic best. As traffic needs change, the pattern of signal operation changes.

Every Broad Street intersection has side street vehicle detectors, pedestrian push buttons, and a signal light controller. These divide green light time at each corner according to its individual traffic needs with minimum interference to the major Broad Street flow.

The new electronic signal equipment enables Broad Street to serve its traffic better these days. There is less stopping, less waiting, less unnecessary delay. There is more orderliness, more freedom, more efficiency of movement.

Let Automatic Signal tell you how practical imagination can help solve your traffic signal problems. Write for Bulletin E-222 on "Electro-Matic® Master".



AUTOMATIC SIGNAL DIVISION
EASTERN INDUSTRIES, INCORPORATED
NORWALK • CONNECTICUT

200,000,000 Feet In Service Today!

ORANGEBURG®

ROOT-PROOF PIPE AND FITTINGS

Over 200,000,000 feet of Orangeburg Pipe are in service today from Maine to California. Its recorded use in sewage disposal work dates back to 1906.

Orangeburg's root-proof joints and its resistance to corrosion make the pipe particularly adaptable for house sewers and other underground non-pressure uses.

Through its record in actual service, Orangeburg has gained acceptance by leading approving authorities, architects, engineers, plumbers and builders.

Outstanding quality is the big reason. Orangeburg is strong, tough, resilient . . . withstands traffic tensions . . . temperature changes. Resists acids and alkalies in ground waters and sewage wastes . . . lasts for years underground.

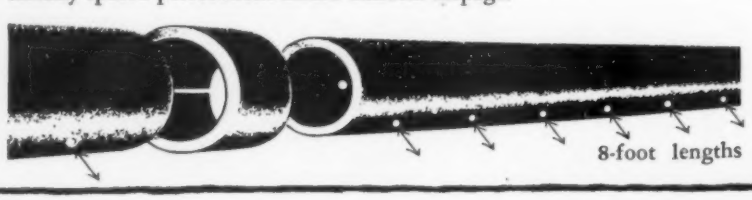
Orangeburg makes quick work of installation. Light 8-foot lengths are easy to handle. Taperweld Joints seal root-proof without cement or compounds.

Write Dept. **PW66** for Engineers' independent report on Orangeburg Sewer Pipe.

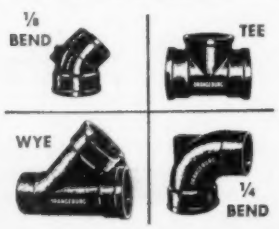
ORANGEBURG MANUFACTURING COMPANY, INC.
ORANGEBURG, N. Y. West Coast Plant: NEWARK, CALIF.

ORANGEBURG Also Comes *Perforated*

for foundation drains, septic tank disposal fields, subsurface drainage of lawns, fields, wet-spots everywhere. Snap couplings keep pipe in line. Scientifically spaced perforations assure uniform seepage.



THESE EXCLUSIVE ORANGEBURG FITTINGS SIMPLIFY INSTALLATION



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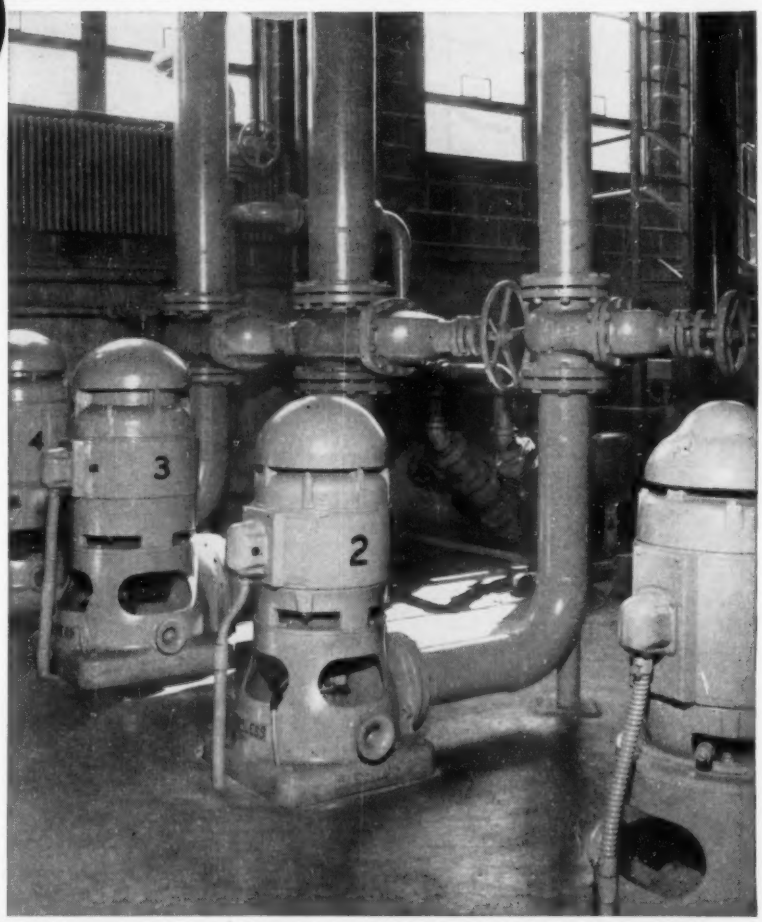
Vertical Versatility

IN PUMPING LIQUIDS FROM SHORT SETTINGS

PEERLESS PUMPS

PEERLESS INDUSTRIAL SERVICE PUMPS

3 PRODUCTION DESIGNS . . . Standard, Heavy-Duty and Special Service Types Provide Widest Flexibility in Application



Single and Multi-Stage Units Available Engineered to the Individual Application

Advantages and Features of the Peerless Vertical Industrial Service Pump

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→ **SPACE SAVING**—Requires minimum floor space.

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PW

Now's the time to mail this month's Readers' Service card.

Note how "Telvar" has kept the guard-rail area free of vegetation. Untreated section at left shows kind of growth involved, growth that causes fire hazards, cuts visibility and often impedes drainage.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 80 Richmond Street West, Toronto, Canada.

Spray just once with Du Pont TELVAR®

WEED KILLERS

When you use "Telvar" weed killers, vegetation is killed through the roots and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

• • •

Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

On all chemicals, follow label instructions and warnings carefully.

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WEED and BRUSH KILLERS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Alameda Naval Air Station—Photo courtesy Clyde Sunderland—Oakland

From Bay-bottom to airport runways at record low cost

BITUMULS®-treated sand/clay solves Navy paving problem at Alameda, California

TODAY, the runways of the Alameda (Calif.) Naval Air Station carry the heaviest of aircraft traffic, both in weight and volume.

Yet these same runways were constructed from sand/clay fill, dredged from the bottom of San Francisco Bay at a "bargain cost." The key to this performance and economy has been *Bitumuls Emulsified Asphalt Stabilized Base.* About 3 million sq. yds. of paved area at this Air Station have been built over a period of some 15 years; and during that time the savings as compared with alternate proposals have mounted to more than one million dollars.

Alternate methods considered by the Engineers of the Public Works Office were the construction of asphaltic concrete or macadam types that required the costly importation of crushed aggregate from long distances; or the treatment with Bitumuls of native red rock from the foothills. For these types over 500,000 tons of aggregate would have had to be imported for an average 5" depth of pavement base.

The dredged-in-place sand/clay from the Bay-bottom was stabilized with Bitumuls (about 6% average). This not only gave adequate bearing value at lower cost, but provided other unique advantages, such as:

1. **FLEXIBILITY,** for conformance to minor expected settlement.
2. **RESISTANCE TO ABSORPTION** of capillary moisture from the sub-base (only 3 ft. approximately above tide level).
3. **SPEED OF OPERATIONS** — Mixing Grade Bitumuls could be easily mixed with the damp sand/clay at record speeds compared to other types.

Bitumuls continues to be used at this Air Station in sand/clay mixes of varying designs to provide adequate load-bearing capacities for various types of pavement base. With increasing traffic and heavier loads, many of these areas have been surfaced with wearing courses, such as Asphaltic Concrete, Bitumuls Armorcoats or Surface Treatments.

An important factor in this very successful paving operation was the use of special grades of Bitumuls that are treated for use with hydrophilic or water-preferential sands. Full information on these products is available at a Bitumuls office near you.

Applying Bitumuls to windrowed sand/clay material. *(Official United States Navy Photograph)*

The Bitumuls-stabilized sand/clay is spread, then compacted to specified density.

American Bitumuls & Asphalt Company

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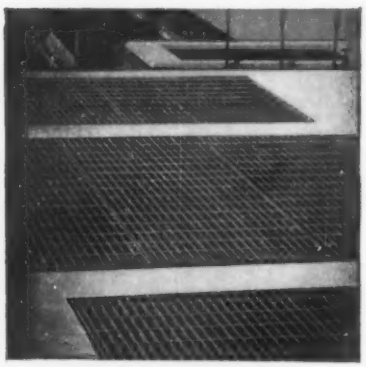

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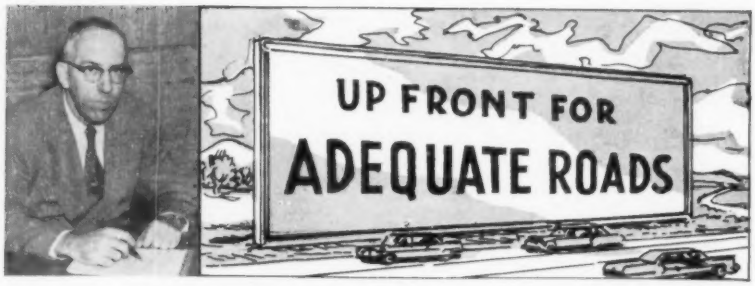

by LEO J. RITTER, JR.

Highway Consultant

Another Step — As this is being written, the House has just passed the new highway bill (the Fallon Bill by a smashing 388-19 margin. As everyone who can read knows, the bill calls for $51.5 billion worth of new roads over the next 13 years; the companion Boggs bill provides new taxes to help foot the bill.

The bill now, of course, goes to the Senate for action. As you remember, last year the Senate passed its own highway bill—the Gore proposal. Now, it will be necessary for a compromise to be reached or for the Senate to pass the Fallon Bill.

The battle is far from over, but present prospects are brighter than at any time in the last 18 months. There will have to be some "give-and-take" to get a bill passed because of several controversial portions of the Fallon Bill—these include (1) the application of the Davis-Bacon Act (controlling wages) to construction on the Interstate Highway System; (2) freezing of present State limitations on truck sizes and weights; (3) reimbursement of 5 percent of the cost of relocating public utility lines; and (4) new taxes, particularly on trucks.

It's going to be interesting—with this being an election year and all. A prediction? Impossible at this stage, although your writer feels that a compromise probably will be reached and a major highway bill enacted. Some sort of bill *must* be passed, since the Federal Highway Act of 1954 expires this year.

TV — We are beginning to get more and more applications of television in highway and street engineering. One of the more recent applications was carried out by the Department of Traffic of the City of New York to check pedestrian and vehicular traffic flow at Columbus Circle (Manhattan). There are eight feeder roads coming into this complex intersection. Purpose was to check a new traffic pattern at this location, before the completion of the Coliseum throws an additional load on the already overburdened circle. Up in Milwaukee, the Harnischfeger (P&H) people were telling us about one of their crane-shovel units which has recently been equipped with a 230-foot crane boom. The unit is being used in the erection of a 23-story building. Since the operator has difficulty seeing the end of the boom and the load he is placing, a TV camera has been installed near the boom tip; the operator then watches a monitor in the crane cab.

Asphalt Curbs — A type of construction which has always intrigued us is the asphalt curb and gutter. Asphalt curbs, with or without gutters, are built of heavy-duty asphaltic concrete. Essentials of the method were covered in the April issue of the *Asphalt Quarterly*, published by the Asphalt Institute. The Institute also publishes *Asphalt Curbs and Gutters*, Information Series No. 92. New developments in equipment permit the rapid placing of the asphaltic mixture in a variety of cross sections. Costs reportedly range from 50 to 70 cents per lineal foot. The machines do not require the use of forms and can place more than 2,000 feet of curb per day.

Airports — Edward P. Curtis, Vice President of Eastman Kodak Company, has been appointed special assistant to President Eisenhower to coordinate planning of aviation facilities. Mr. Curtis will be responsible for (1) direction and coordination of a long-range study of requirements for aviation facilities; (2) the development of a comprehensive plan to meet the needs disclosed by the study, in the most effective and economical manner; and (3) the formulation of legislative, organiza-

Texas Builds Soil-Cement Widening—2 Miles a Day*

P&H Soil Stabilizer Processes 9,000 Sq. Yd. Daily With Perfect Control of Quality

Close-up of P&H Model LA-88 Single Pass Stabilizer processing soil-cement.

Texas State Highway 79, originally built in 1928-29, was recently modernized in record time for today's traffic needs.

State Highway Officials decided the old 18-ft. pavement should be widened to 24 ft., for a total of 17 miles. Low-cost and maximum use of local materials were musts. Low bidder among nine contractors was Austin Asphalt Company, Dallas.

P&H Stabilizer Key to High Production

With the old shoulder soil removed to a 14-in. depth and an 8-ft. width on one side, 30 cu. yd. per station of crushed sandstone were dumped on

Behind the Stabilizer, two sheep's-foot rollers compacted the mixture.

the concrete pavement at regular intervals. This was bladed into the trench, watered and rolled for an 8-in. sub-base. Over this, 20 cu. yd. per station of crushed sandstone were placed to a 7-ft. width. Cement, for an 8% cement factor, was then spread, working no more than 1,000 ft. ahead of the P&H Soil Stabilizer as a guard against cement loss. Actually, this distance ahead was rarely reached, though, because of the high mixing speed which the Stabilizer maintained.

A More Stable, More Durable Base

Behind the cement spreader, the P&H Stabilizer pulverized the partially compacted sandstone, dry mixed it with cement, added the proper amount of water and deposited a uniform layer of soil-cement ready for immediate compaction.

Here curing seal is applied at the rate of 0.2 gallon per sq. yd.

Then, after curing, a 250 lb. hot-mix bituminous surface was placed over the old pavement and widening in two courses to complete modernization of this veteran road. The road was kept open to traffic throughout construction and the widening was opened to traffic as soon as the curing seal was blotted.

For more information on P&H "Single-Pass" Soil Stabilizers, write to C. R. Morgan Jr., P&H Soil Stabilizer Division, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

Side view of P&H Model LA-88 Stabilizer. Only 1 man required to operate.

** The following data is based on a January, 1955 presentation to the American Road Builders' Association Committee on Soil-Cement stabilization by Mr. A. D. January, Wichita Falls, Texas, Senior Resident Engineer of the Texas State Highway Dept.*

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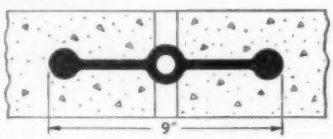
HOLLOW BULB—FOR EXPANSION JOINTS

Insures permanent, watertight seals in joints where considerable movement due to expansion and contraction is expected. Flexible and elastic with a very high degree of tensile strength to withstand both lateral and shearing movement. Widths—6" and 9" . . . lengths to order.



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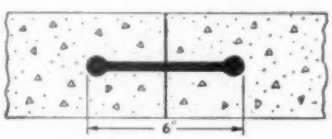
Made of durable, elastic cured rubber which has high tensile strength and flexibility for effective sealing of contraction and expansion joints against hydrostatic pressure. Carefully manufactured to insure dense, homogeneous cross section for greatest service life. Widths—6" and 9" . . . lengths to order.



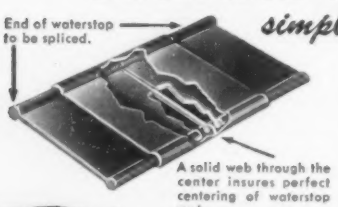
SPLIT TYPE WATERSTOP

faster, easier installation

A new Servicised development already in wide use because it reduces installation time and cost by eliminating splitting of form. One half of width is split to permit fastening to inside of bulkhead in the form of a "T." After section is poured, form is removed and divided sections are joined together by stapling. Pat. Pend.

WATERSTOP UNION

simplifies Field Splicing



Permits a faster, simpler method of field splicing, using only rubber cement. The union is hollow and is made from rubber meeting the same specifications as the waterstop. Available for splicing 6" and 9" Dumbbell and 6" and 9" Hollow Bulb Waterstops. Pat. Pend.

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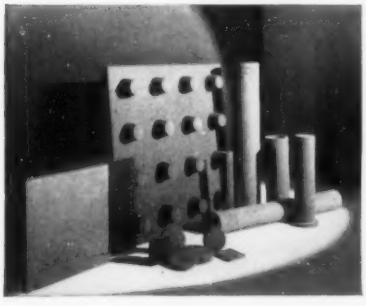
tional, administrative and budgetary recommendations to implement the resulting master plan. As many of you know, this is the time for long-range planning—since many airport facilities are overworked and badly overloaded, air space allocation and traffic control are becoming more difficult everyday, and civilian jet transport aircrafts will soon be with us in quantity. Speaking of jets, the CAA has announced it will shortly have on hand a "flying laboratory"—a B-47 loaned by the Air Force. The CAA will fly it into existing airports for practical weather study and development of jet operations. Among the problems of the jet age will be the handling of passengers and baggage, length and strength of runways, the possible use of vertical take-off aircraft, noise and many others.

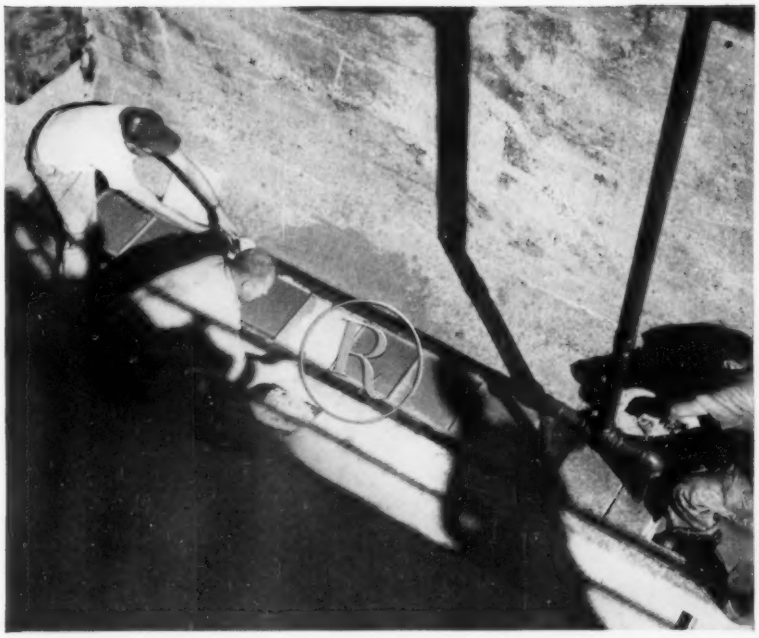
Traffic Safety — On April 30, the National Safety Council declared a National "traffic accident emergency" in the wake of the worst March highway fatality recorded in history. Dead in March in traffic accidents were 2960 people. Indications are that 1956 may set a new high mark for traffic deaths, unless something is done and done fast. The council has urged each state Governor to end the "critical" situation and stop the rising highway death toll. What to do? There certainly is no easy answer. Our own feeling is a combination of highway and street improvement *and* greatly increased and much harsher enforcement of existing traffic laws.

Inverted Crowns — Professor John A. Oakey of the Department of Civil Engineering of North Dakota State College has written an interesting report regarding recent design and construction of campus roads. The report appears in the March-April issue of the Educators Exchange, published by the Educational Division of ARBA. A somewhat unusual feature of the roads—which were built of Portland cement concrete—is an inverted crown. This, of course, puts the gutter for storm drainage right down the middle of the road. One of the major advantages of this type of design is economy of construction, since only one inlet to the storm drainage system is required at each intersection, instead of four. The resulting saving was estimated at $1000 per intersection. Another big advantage in that area —which Professor Oakey compares

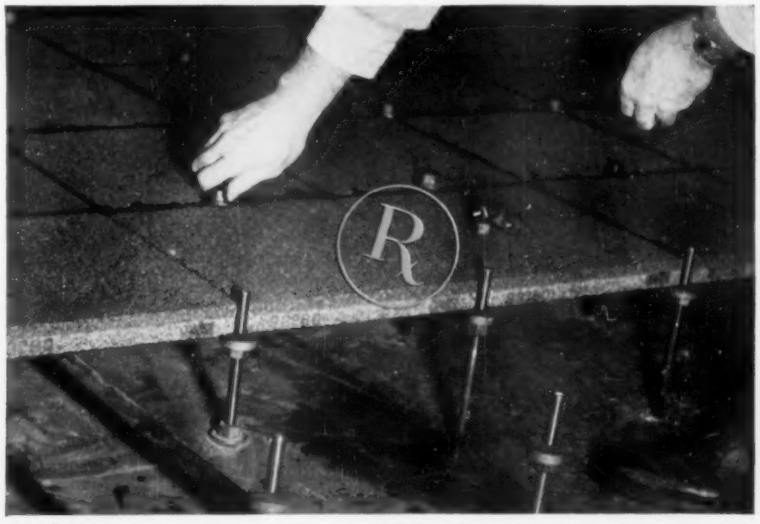
Two ways you save with Norton plates

NORTON ℞ (engineered and prescribed) porous mediums last extra-long, reduce maintenance in both sewage and filtration plants





After 16 years of service, Norton ALUNDUM* plates are replaced with new ones in a modern sewage disposal plant.



Good for many years to come. A water filtration plant makes sure of long, trouble-free service by installing Norton plates.

Public works engineers all over the country know that among the most dependable aids to efficient, economical sewage disposal and water filtration are Norton ALUNDUM porous mediums — *engineered and prescribed* for longest lasting, lowest cost performance.

Thanks to their *controlled structure* processing, Norton mediums have the even distribution of pores that makes them the ideal ℞ for uniform diffusion. And Norton tubes have this uniform diffusion over their entire area, because of their seamless construction — which also makes them much easier to clean.

You get additional savings with Norton porous mediums because of their exceptional resistance to breakage and chipping and to cleaning acids. Made in the form of plates, discs and tubes, they cover a wide range of applications, including activated sludge aeration and gravity, pressure or diatomite filtration.

Norton can help you by supplying illustrated booklets, charts, tables and other important information on your own use of porous mediums. Ask your Norton Representative or write direct to NORTON COMPANY, Refractories Division, 225 New Bond St., Worcester 6, Mass.

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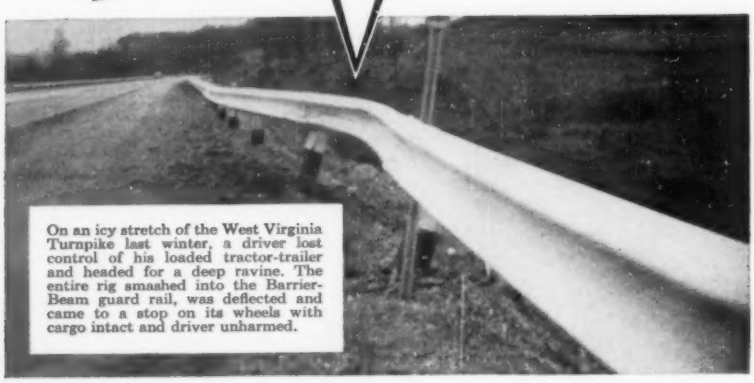

On an icy stretch of the West Virginia Turnpike last winter, a driver lost control of his loaded tractor-trailer and headed for a deep ravine. The entire rig smashed into the Barrier-Beam guard rail, was deflected and came to a stop on its wheels with cargo intact and driver unharmed.

Specify USF BEAM-TYPE GUARD RAIL

USF BARRIER-BEAM

A rugged deep beam section with the famous rounded Safety-Top, noted for high impact strength, good deflection, maximum protection and ease of installation and maintenance.

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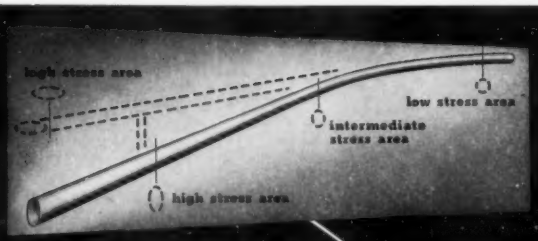
to Lower Slobbovia—is that inlets are not buried under tons of snow and ice deposited at the sides of the street by snow removal equipment. Another advantage is that, with snow and ice, a parked car has comparatively little difficulty pulling into the traffic lane, since travel is downslope.

The only real disadvantage seems to be that the single inlet at an intersection has limited capacity, thus resulting in short-time ponding during periods of heavy runoff.

Flexible Pavement Design — A very interesting report on a method of designing flexible pavements for strength—instead of thickness—is contained in the March issue of the *Crushed Stone Journal*. The article was written by R. C. Herner of the CAA Terminal Development and Evaluation Center at Indianapolis. It is a report on the results of work performed to date on the "Load Transmission Project." Too detailed to abstract here, practical applications of the results of the study in comparing various types of flexible pavement structures are explained, and correlations with the triaxial test demonstrated. Recommended reading for those interested in the subject.

From Here and There — The Air Force has stirred up a ruckus with the issuance of an order requiring the use of portland cement concrete for the full length of new airport runways, as well as for aprons, warm-up pads, and so on; the asphalt people don't go for that, at all. . . . The 4th Annual National Highway Conference for County Engineers and Officials, sponsored by the County and Local Roads Division of ARBA, will be held at Mackinac Island, Michigan, on September 17-19. . . . Plans for double-decking the George Washington Bridge, which links New York City with Bergen County, N. J., have hit a snag; there has been so much debate over the proposal that a bill for its financing probably will not even be introduced into the New Jersey State legislature this year. . . . A proposed ton-mile tax on trucks died in committee before reaching the Michigan legislature. . . . Recent tests by Motor Vehicle Research, Inc., demonstrate the high effectiveness of Rosa Multiflora Japonica, an Asiatic plant used to form border barriers on rural highways, in absorbing the impact energy of a moving vehicle.



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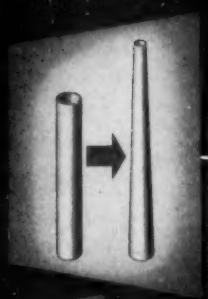

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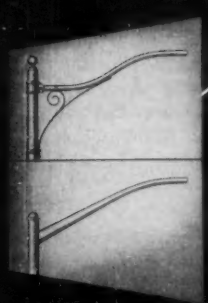
FIRST to stress use of castings of heat-treatable aluminum alloy, and first to introduce permanent mold castings for transformer bases, shoe and pedestal bases . . . with smooth surfaces and strong grain structure.



FIRST to eliminate unnecessary scrolls, tie-rods and other ornamental frills.

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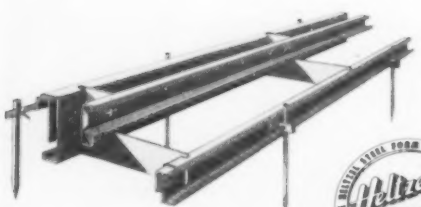
"FOR SIMPLICITY AND SPEED—I'LL TAKE HELTZEL FORMS EVERY TIME" . . . says leading Cleveland Contractor

Joe Galier, of the J. & S. Galier Company, on-the-job with a few of the hundreds of feet of Heltzel Forms he uses daily in his business.

Left—Setting forms perfectly is an easy matter. Many curb and gutter shapes can be worked-out from a simple set of these versatile forms.



"Heltzel has made it a simple matter to get perfect curbs every time," says Joe Galier, one of the principals of the J. & S. Galier Company of Cleveland, O. "It requires only a few minutes to train a worker to set them up."

"We've used Heltzel Curb and Gutter and Sidewalk Forms for many years and, frankly, I've yet to find a better piece of equipment for the job," Mr. Galier continues.

The story's the same wherever you go—leading contractors, like the J. & S. Company, who have tried them all, finally choose Heltzel Forms as the finest available. Next time you're in the market for additional forms why not talk with the Heltzel representative in your area—for the finest costs no more.

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control dust quickly and effectively with GULF SANI · SOIL · SET

GULF SANI-SOIL-SET is the practical answer to your dust annoyance problems. Here are a few of the many good reasons why it will pay you to investigate this efficient dust-control medium now:

HIGHLY EFFECTIVE—Gulf Sani-Soil Set eliminates dust annoyance completely immediately after application. No long waiting periods are necessary before the ground is ready for use. The dust allaying effect is accomplished by the action of the compound in adhering to and weighing down dust particles.

LONG LASTING—Because of its extremely low volatility and insolubility in water, Gulf Sani-Soil-Set remains effective for long periods. One application per season or year is usually sufficient.

EASILY APPLIED—Gulf Sani-Soil-Set is free-flowing, easy and pleasant to use. It can be applied by hand-sprinkling or by sprinkling truck, and spreads quickly.

SAVES MAINTENANCE EXPENSE—Gulf Sani-Soil-Set minimizes dust annoyance and expense in near-by houses, stores, and laundries.

Write, wire or phone your nearest Gulf office today and ask for a demonstration of the advantages of this modern proven dust allayer. If you have not yet received a copy of the pamphlet which gives further information on this quality Gulf product, mail the coupon below.

GULF

Gulf Oil Corporation · Gulf Refining Company
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Please send me, without obligation, a copy of your pamphlet, "Gulf Sani-Soil-Set—the modern, proven agent for controlling dust."

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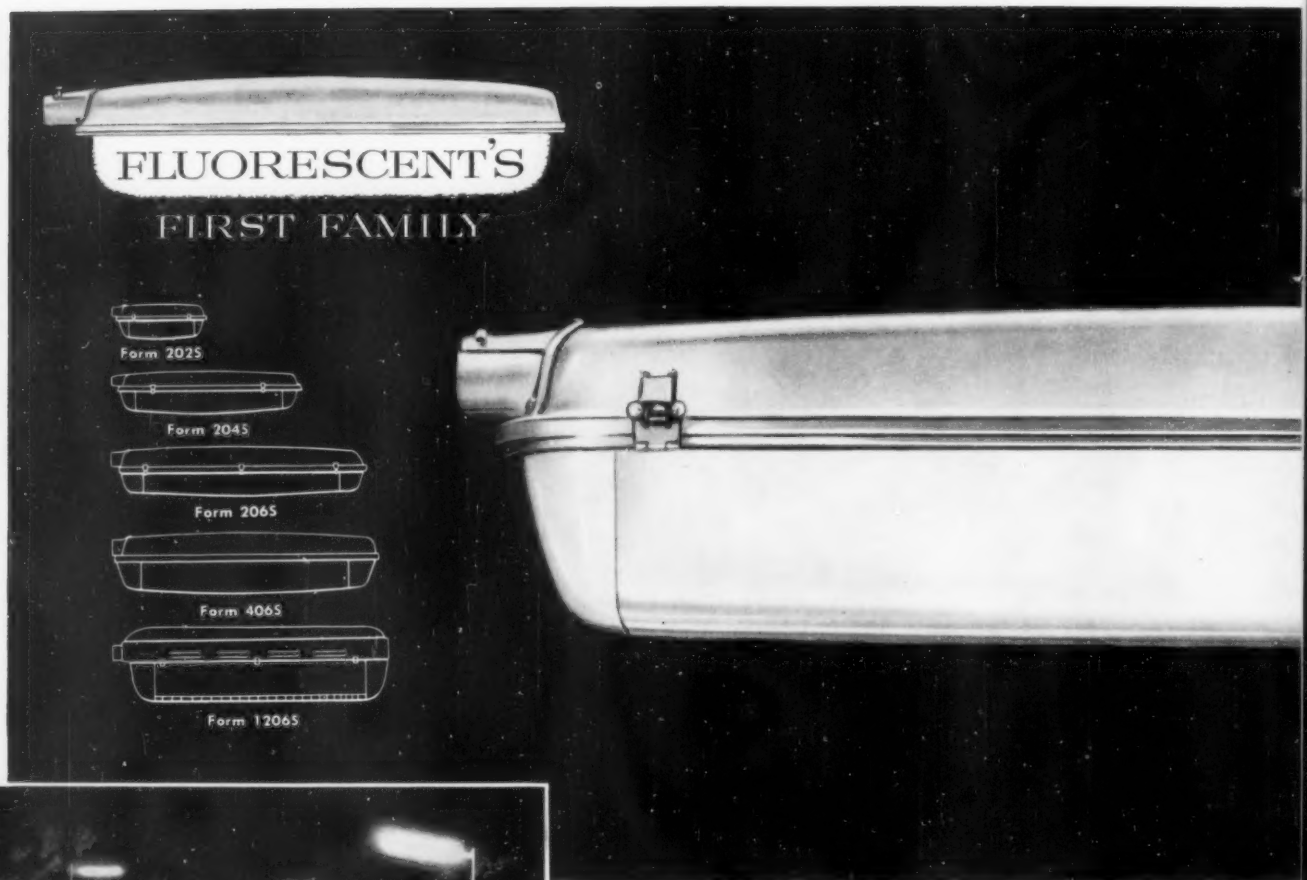
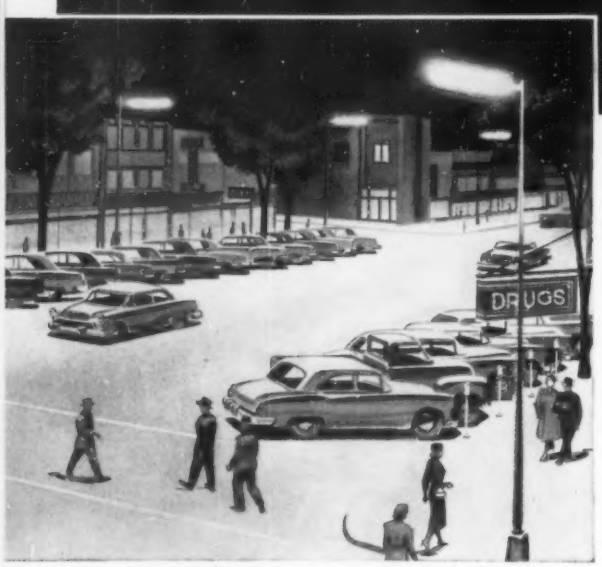
New G-E form 206S Fluorescent

improves appearance, visibility, adds safety





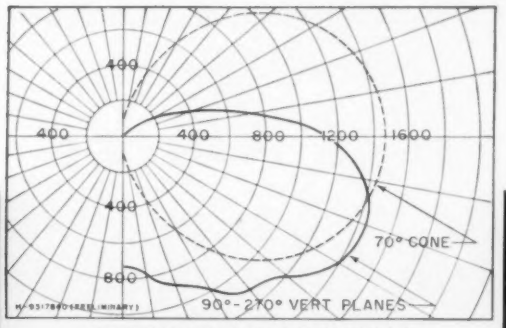
COMFORTABLE SEEING is added to safety in this shopping center. Business is increased because the pleasant atmosphere these G-E Form 206S luminaires create draws people into the area, encourages them to linger and shop, and develops "repeat" trade.

Medium business and shopping areas often are improperly lighted because they are too small to fall into a "main-street" category. Yet these areas get "main-street" type automotive and pedestrian traffic . . . have the same kind of safety and visibility problems. The answer is the new G-E Form 206S Luminaire (10,600 lumens). Easy to install and requiring little maintenance, this luminaire provides crisp, cool, diffused light with virtually no glare. Pavements have exceptional uniformity of brightness—even when wet. Comfortable seeing like this is good for business, too . . . draws people into the area to shop.

The Form 206S Luminaire is another member of G.E.'s revolutionary family of fluorescents, now making it possible to bring all the advantages of this type of street lighting—better visibility, more comfortable seeing, lower maintenance—to every street in the community. It's a development made possible by a co-ordinated design of luminaires, lamps, ballasts, and brackets for outdoor service. And each member of this family—whether it's the 202S (2700 lumens), 204S (6600 lumens), 206S (10,600 lumens), 406S (21,200 lumens), 1206S (64,000 lumens)—

Luminaire

to primary traffic areas



DISTRIBUTION OF INITIAL CANDLE POWER

contains many new structural design improvements to assure installation, operating and maintenance advantages. Some of these advantages are slipfitter mountings, weather-proof engineering, one-piece side-hinged globe, detachable reflector, pre-wired terminal board, integral ballasts, and new recessed, double-contact-base lamps.

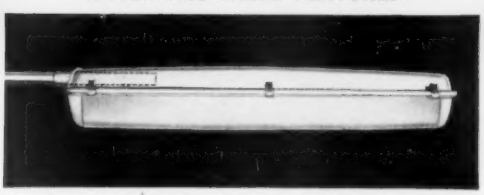
For more information on the outstanding new General Electric Form 206S or any other member of "Fluorescent's First Family," contact your nearest G-E Apparatus Sales Office, or write Section 452-164, General Electric Company, Schenectady 5, New York.

"Out of Darkness," a dramatic 16-mm sound film on how one community met and solved its street-lighting problems, is available from your nearest G-E Apparatus Sales Office.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ONLY NEW G-E FLUORESCENT LUMINAIRES OFFER ALL THESE FEATURES



SLIPFITTER MOUNTING . . . pipe bracket slides easily into luminaire, giving perfect support and eliminating heavy, cumbersome clamp brackets. Simple, self-contained, two-bolt adjustment permits fast, easy leveling.

WEATHERPROOF ENGINEERING... new, resilient gasket material between hood and globe provides a uniform, positive seal against all elements. One-piece plastic globe retains clear appearance in all weather.

They have a tremendous work record

THESE WHITES are ENGINEERED for MAXIMUM WORK

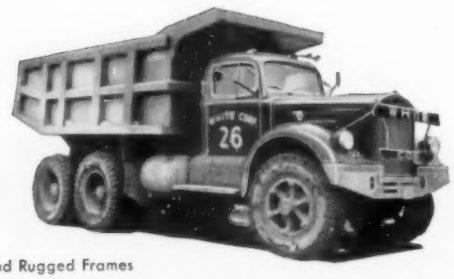
Just like every White Truck that goes into service, these rugged and husky Whites are built for extra earning power—engineered right to the job. They are part of a huge fleet of Whites in the Massachusetts construction industry doing a great job with top payloads—low operating cost and longer truck life.

Tailored to Restrictive Laws for Greater Payload

Ideal specifications under their operating conditions. 170 in. wheelbase, five-speed main transmission, three-speed auxiliary, 9.02 to 1 ratio rear axle.

Let WHITE Show You

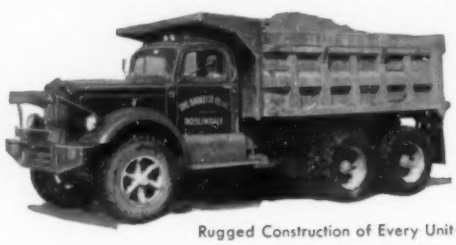
We can do the same kind of creative engineering for you—tailor your equipment to exact operating conditions for greatest earning power. See or call your White Representative.



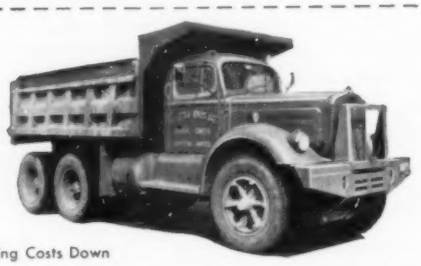
Tough and Rugged Frames

Extra Payload 13 ft. Bodies

Powerful White Mustang Engines



Rugged Construction of Every Unit—Every Feature



White Quality Keeps Operating Costs Down

FOR MORE THAN 55 YEARS THE GREATEST NAME IN TRUCKS

White

THE WHITE MOTOR COMPANY
Cleveland 1, Ohio

Now's the time to mail this month's Readers' Service card.

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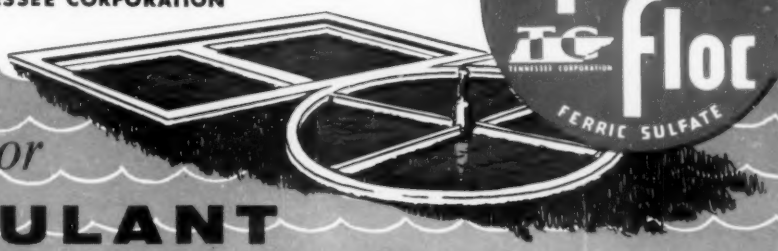

The Superior
COAGULANT

With The Plus
FACTORS

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

Excellent Taste and Odor Control — **Coagulation Over Wide pH Range**
Rapid Floc Formation — **Color Removal** — **Bacteria Removal**
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WATER TREATMENT

Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

SEWAGE TREATMENT

Ferri-Floc coagulates wastes over wide pH ranges — It provides efficient operation regardless of rapid variations of raw sewage — Is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

LIQUID SULFUR DIOXIDE
HIGHEST QUALITY
SO_2
Available in:
Cylinders, Ton Drums,
Tank Trucks and Tank Cars

LIQUID SULFUR DIOXIDE

As an antichlor SO_2 has proven to be very effective in controlling accurately the amount of residual chlorine in water supplied to the distribution system.

The quantity of SO_2 needed to remove chlorine is in the ratio of 0.905 parts of SO_2 for each part of chlorine to be removed or reduced.

For plants operating under conditions where control is difficult, superchlorination and dechlorination with SO_2 is more practical than the "break-point" treatment.

COPPER TC SULPHATE
Available in 100 pound bags.

COPPER SULFATE

Long recognized as essential to properly control algae, and other microscopic organisms. Copper Sulfate will control about 90% of the micro-organisms normally encountered in water treatment plants more economically than any other chemical.

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FREE BOOKLET Let us send you without charge, a 38-page booklet that deals specifically with all phases of coagulation—just send us a postal card.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Westinghouse fluorescent luminaires' exclusive features speed installation and maintenance

Now's the time to mail this month's Readers' Service card.

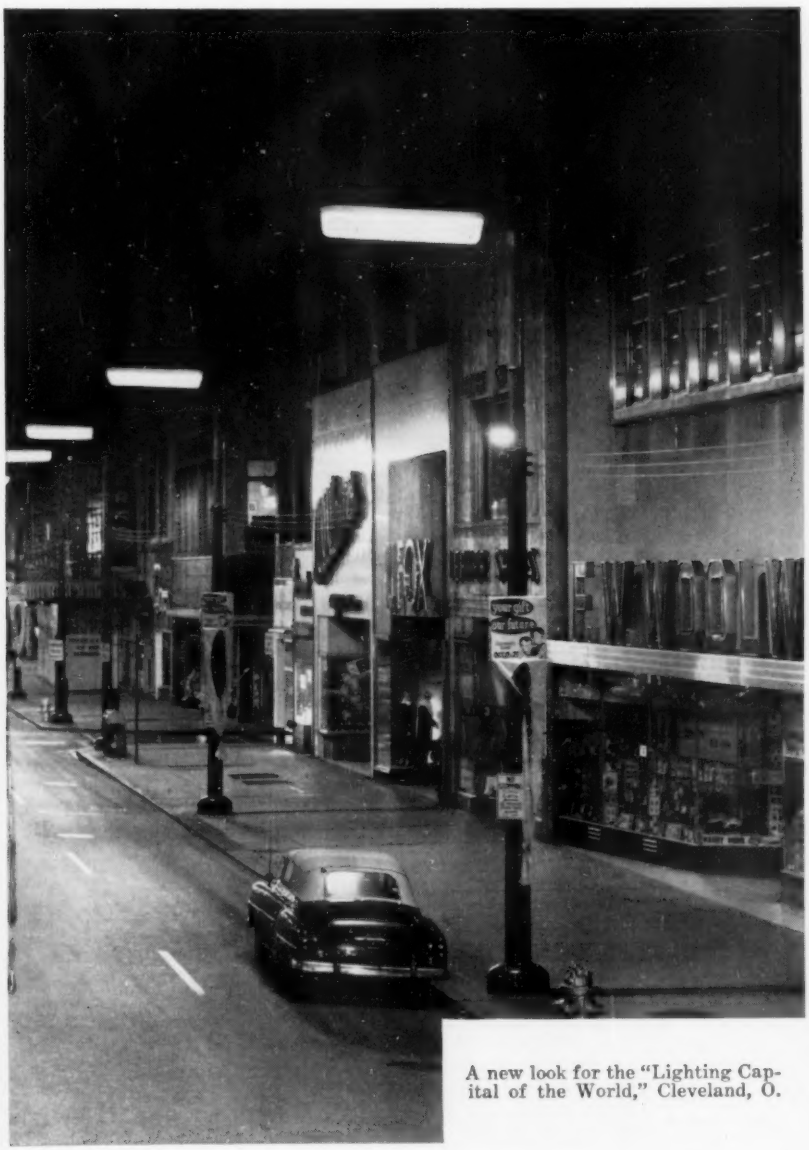
Look what's new in Cleveland! A great white way of fluorescent light by Westinghouse 4FSL-72 street lighting luminaires. The change from the old system to the new was made in record time because Westinghouse units are designed for quick installation and simple maintenance. The importance of these advantages can be measured in real savings—savings in labor cost during installation and for the maintenance life of your street lighting system.

If you are planning a fluorescent street lighting program, examine these important features, and you will agree that the Westinghouse 4FSL-72 fluorescent luminaire is built for a lifetime of efficient, economical operation.

More information? See your nearby Westinghouse representative, or write Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio. J-04390

WATCH WESTINGHOUSE

where **BIG** *things are happening for* **YOU**



A new look for the "Lighting Capital of the World," Cleveland, O.

Attaching luminaire to pole . . . is done by tightening four bolts on the heavy-duty mounting bracket. 4FSL-72 may be mounted horizontally or at a 15°-30° angle for wider light distribution.

Connecting wiring . . . three knurled nuts are loosened *without tools*, allowing reflector to hinge down for easy access to ballast and wiring. Wire is brought through watertight bushing; leads are then attached to terminal block.

Closing luminaire after installation . . . cover may be opened or closed from either side by releasing three pressure latches. Cover is clear acrylic plastic which will not discolor with age. Fiber glass housing *never* requires painting.

Get full details of this month's products . . . mail your Reader's Service card today.

MORE and MORE POOLS are using

Josam SWIMMING POOL FITTINGS for SANITATION AND SAFETY

...because JOSAM pool fittings maintain highest standards of sanitation and hygiene for bathers . . . keep pool water in tip-top condition by providing a continuous supply of clean water through complete circulation and proper drainage. No wonder designers of swimming pools everywhere today are insuring perfection of pool operation by specifying JOSAM fittings.

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In JOSAM Manual SP-5, free upon request, you can select typical plans and layouts which will meet the requirements of every condition in every community. If you are building or remodeling, send coupon today for your copy — it is the "authority" in the swimming pool drainage field. Don't be without it!

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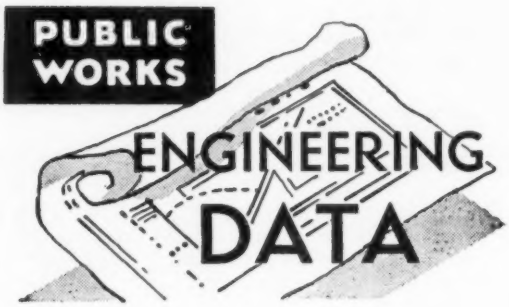


Algae Control in Winnipeg Aqueduct Operation

At times during the summer, algae cause tastes and odors to develop in the water supplied by the greater Winnipeg District. Copper sulphate can be used to control some of these organisms but this requires a considerable amount of contact time, which only permits its use where large storage reservoirs are available. Consequently, much of the water could not benefit from this treatment.

During 1953 and 1954 the District, in cooperation with the City of Winnipeg, carried out experiments in the use of copper sulphate applied at the aqueduct intake, where more than a 40-hour contact period could be obtained while the water was flowing to Winnipeg.

The experiments proved successful and have improved the condition of the water supplied to all municipalities considerably. As a result a copper sulphate feeder was installed in the intake building, replacing the temporary equipment used for experimenting.

Graphite Paints for Protecting Metal Structures

PROTECTION OF bridges, water tanks and other metal structures, especially in areas along seacoasts, in humid climates and in places where exposure to smoke fumes from industrial areas is likely, has always been a problem. Information has been supplied to us by Joseph Dixon Crucible Co. covering the successful application of graphite paint under the conditions listed above. The terms used refer to the Dixon paints.

Pulaski Skyway—The Pulaski Skyway, between Jersey City and Newark, N.J., is the second longest bridge in the world. It passes over two salt rivers, an area of marshes and through a highly industrialized area. Painted originally in 1932 with a red-lead-graphite primer (No. 101) and a graphite finish coat (No. 107 dark group), this structure was not repainted until 1946 - fourteen years later. At that time it was again painted with a red-lead graphite primer and a graphite finish coat. Now in its 10th year, this coating is still giving excellent service.

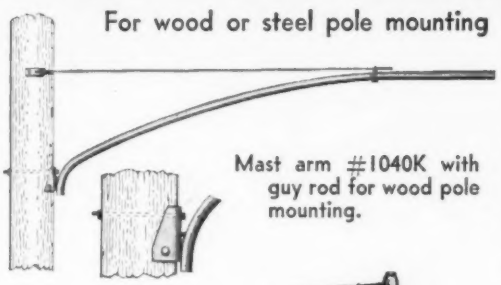
Omaha Elevator—In 1922 the Omaha Elevator was painted with No. 107 natural graphite paint. This painting lasted for 8 years and the structure was repainted in 1930 at which time the No. 107 natural graphite paint was again used. The paint that was applied in 1930 provided satisfactory protection up until 1942, when the elevator was again repainted with the No. 107 Dark Gray Silica Graphite Paint. So far as is known, it has not been repainted to date.

An average life of over 10 years per painting was achieved in spite of the fact that there is a tendency for grain dust to cling to the surface and absorb

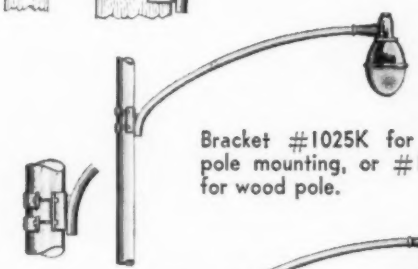
KERRIGAN Weldforged
Steel Brackets & Mast Arms

For Economy & Beauty

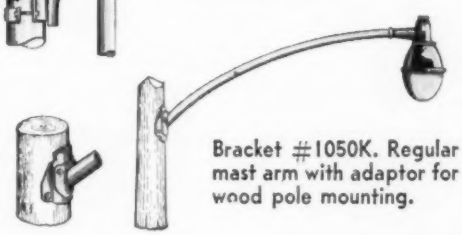
For wood or steel pole mounting



Mast arm #1040K with guy rod for wood pole mounting.



Bracket #1025K for steel pole mounting, or #1035K for wood pole.

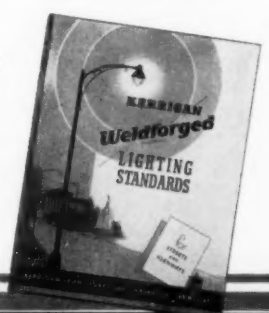


Bracket #1050K. Regular mast arm with adaptor for wood pole mounting.

Kerrigan's complete line of brackets and mast arms are carefully engineered for easy installation and wiring. They meet all I.E.S. street lighting recommendations. So, take advantage of your wood poles now in place and brighten up your city or town NOW!

Let us help you

solve your city's lighting problems. Send for our FREE catalog containing engineering data. It shows how simple installation really is.



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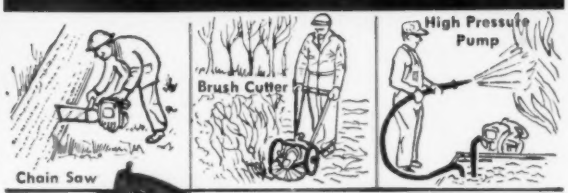

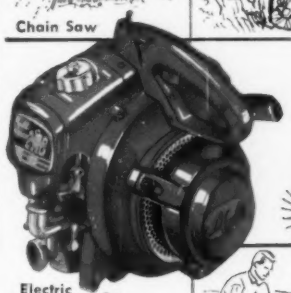

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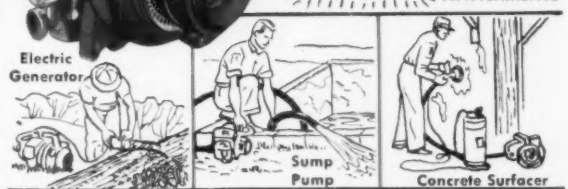
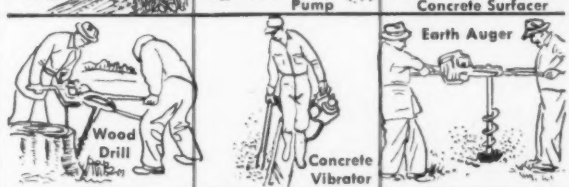
POWERS ALL THESE ATTACHMENTS





A Complete Line of Gasoline Engine Portable Power Tools to speed your work...to cut your costs.

Here's a power packed MALL 2-cycle gasoline engine designed to do many municipal jobs. This lightweight, compact and highly maneuverable engine can power a dozen attachments. These attachments save time and money for your community and can be purchased as the need for each arises.

This engine, coupled with attachments, gives you two or more power tools for the price of one. And, you can depend on MALL for the highest quality, top performing power tools available at the lowest price.

MALL TOOL COMPANY PORTABLE POWER TOOLS GASOLINE • ELECTRIC • AIR
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Send me the Free Gas Engine Tool Catalog—tell me more about MALL TOOLS for municipalities.

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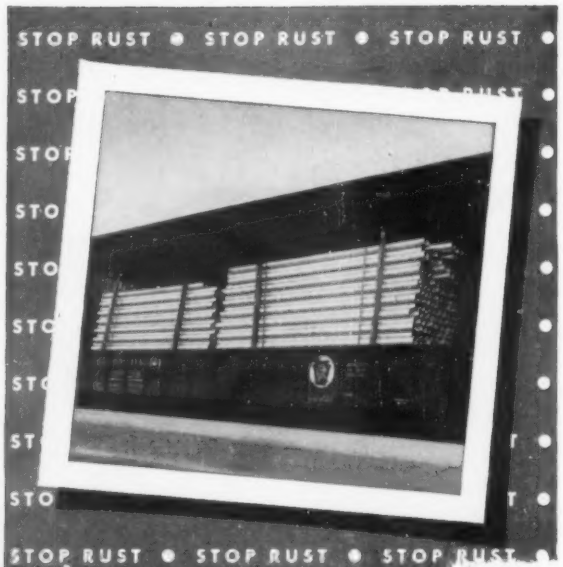


It's Hot-Dip Galvanized

Here's a carload of spiral pipe on its way. Wherever it's installed, you can be sure of trouble-free service. That's something to consider with today's high costs of maintenance. It is estimated that corrosion is costing the United States over five billion dollars a year. By having your products Hot-Dip Galvanized you can greatly reduce these costs. Hot-Dip Galvanizing is more than just a coating, because with Hot-Dip Galvanizing the zinc actually becomes an alloy with the base metal. This means your products will last longer.

Whatever the product may be, if it's iron or steel, have it protected with Hot-Dip Galvanizing. For the best in galvanizing send your products to a member of the AMERICAN HOT DIP GALVANIZERS ASSOCIATION . . . . he has the know-how to give you a top quality job.

Send today for our new booklet "Stop Rust." It gives you the full story on the process, plus a comprehensive coating comparison chart. "Must It Rust" 16 mm film available for showing.

AMERICAN HOT-DIP GALVANIZERS ASSOCIATION

1506 FIRST NATIONAL BANK BLDG., PITTSBURGH 22, PA.

moisture. This is detrimental to paint life: also the temperature variations which occur within a year range from 0 to 100° F, with resultant expansion and contraction of the structure. The film flexibility of the graphite pigment made possible an average life in excess of 10 years on this structure.

Yonkers Water Tank—A 1,500,000 gallon water tank of the city of Yonkers, N.Y., was painted in 1945, with a touchup coat of No. 103 dark red; a first field coat of No. 105 medium gray; a finish coat of No. 108 black on the legs and riser; and a touch-up coat of No. 103 dark red, intermediate coat No. 111 aluminum graphite paint and finish coat of No. 109 bright aluminum graphite paint on the tank. The tank was scheduled for painting in 1955 with essentially the same materials after having provided ten years service life. This water tank is located high on the hill and is exposed to high winds, in addition to normal elements destructive to paint. As with other water tanks the service conditions are severe, as during the summer months when the atmospheric temperature is higher than the water temperature condensation forms on the exterior surfaces of the tank with the result that there is constant dampness during the hot weather.

Hudson River Pier—A pier of the Holland line in Hoboken, N.J., was painted in 1934 with a touch-up coat of No. 101 red lead graphite primer and a finish coat of No. 107 dark gray. The pier was not painted again until 1943, after 9 years service life under severe conditions. This pier extends 915 feet into the Hudson River. It is subject to the dampness from the salt water, salt fogs and sulphurous fumes from tug boats, ocean liners, other railroad and industrial fumes.

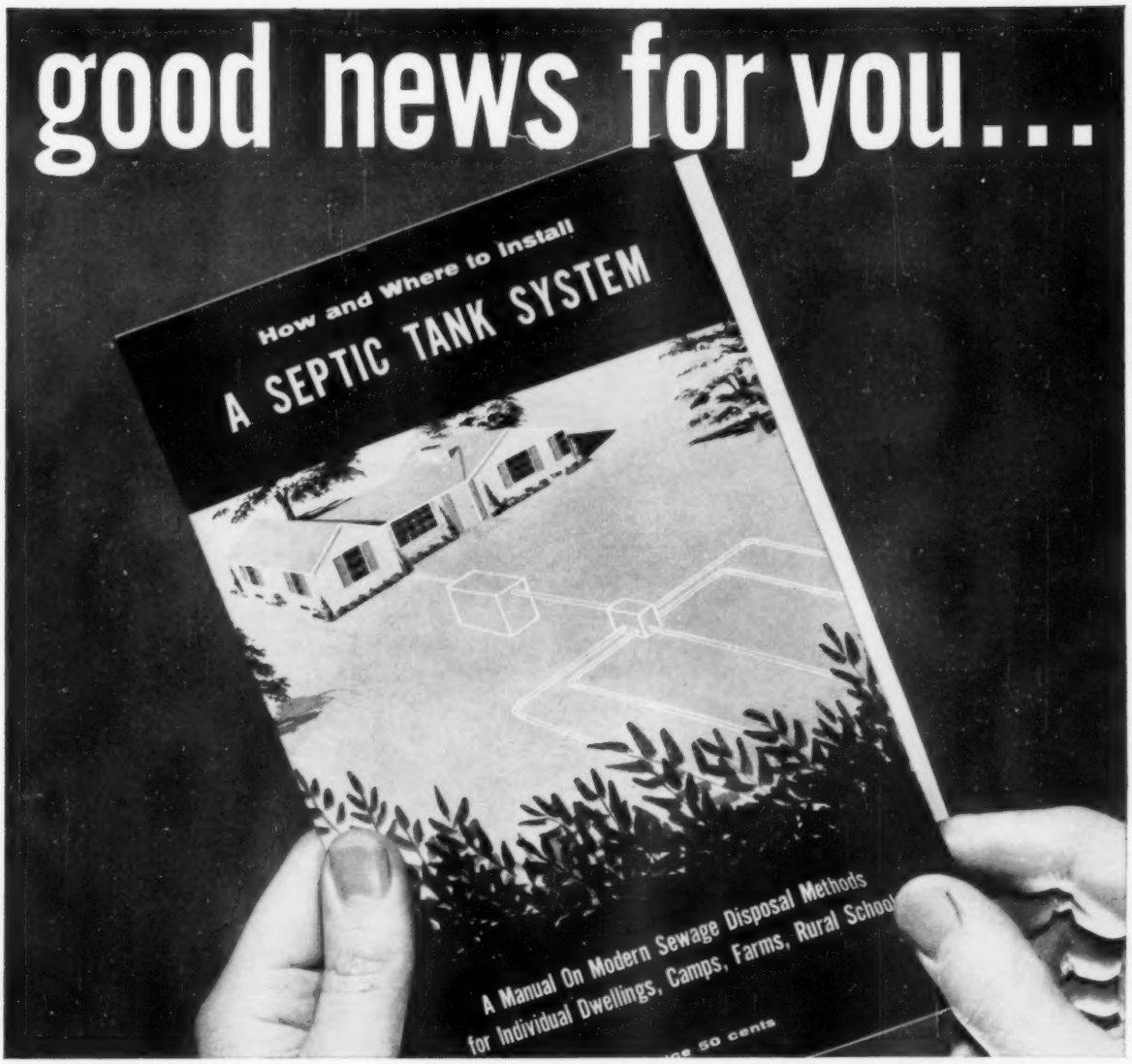
The paint that was applied in 1943 was still reported to be rendering satisfactory protection after 12 years service, during which time only minor touch-up work was done.

Gas Holder—A gas holder in Brooklyn was painted in 1943 with a prime coat of No. 101 red lead graphite primer and a finish coat of No. 104 battleship gray. Located a few hundred yards from the Atlantic Ocean, it is subject to dampness from the salt water, salt fogs and abrasion from sand blown from the beach. The gas holder is within a few feet of Coney Island Creek, which is also filled with contaminated salt water. The dampness at this location is such that during the repainting it was often necessary to wait until after 10 AM for the surface to dry, so that the paint could be applied.

In addition to these severe weather conditions, the holder is directly adjacent to a gas manufacturing plant generating illuminating gas with the result that there was a heavy discharge of sulphur fumes from the gas plant. Despite these conditions, a 10-year service life of the paint has been obtained.

Heat Losses From Asphalt Storage Tanks

Heat losses from uninsulated asphalt storage tanks, according to Asphalt Equipment Co., Inc., are 2 btu for one degree temperature differential per square foot of surface area per hour. With an outside temperature of 50°F and an asphalt temperature of 350°F, the loss is 600 btu per sq. ft. per hour or 14,400 btu per sq. ft. per day. If a tank has a surface area of 1000 sq. ft., the daily loss is 14.4 million btu. Since the heat value of a gallon of fuel oil is 144,000 btu, the equivalent loss is 100 gallons of oil. According to Asphalt Equipment Co., Inc., three inches of good insulation would reduce this heat loss 90 to 95 percent, saving 90 to 95 gallons of fuel oil every day when the temperature averages 50°F.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How and Where to Install
A SEPTIC TANK SYSTEM
A Manual On Modern Sewage Disposal Methods
for Individual Dwellings, Camps, Farms, Rural Schools
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Here's a complete engineer's manual on septic tank installation

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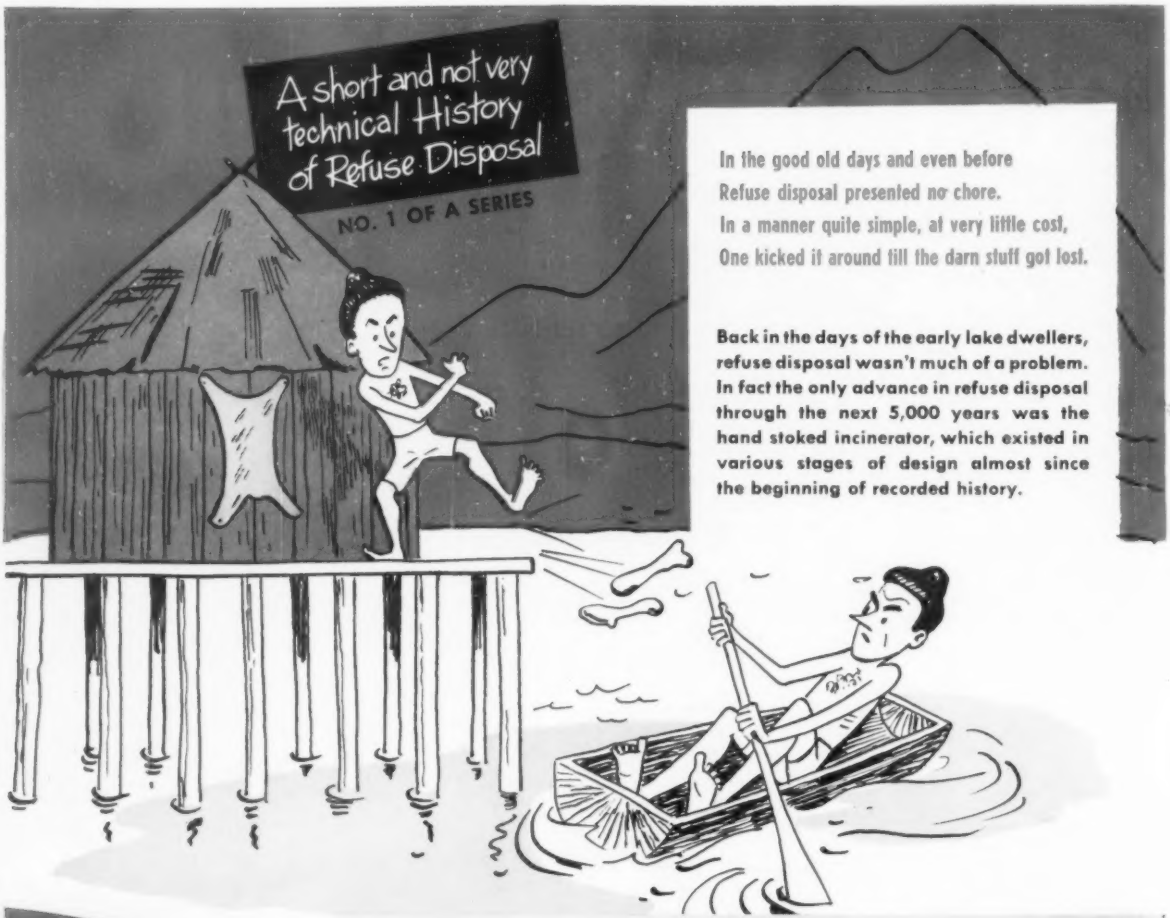

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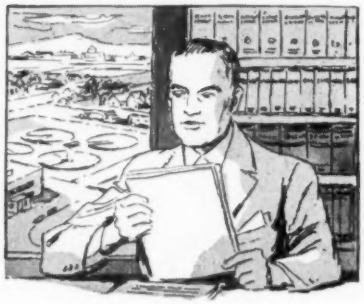


MELVIN NORD,
Dr. Eng. Sci., LL. B.
Registered Professional Engineer

A Concrete Question

A very interesting question relating to bidding on public works contracts was raised in the case of *De Felice & Sons v. Argraves, 19, Conn. Supp. 491; 118 Atl. (2d) 626,* a Connecticut case decided Nov. 3, 1955.

In connection with the construction of a portion of the Connecticut Turnpike, the Highway Commissioner advertised for bids. In the notice to prospective bidders he requested alternate bids, one for the construction of reinforced concrete and one for bituminous concrete pavement. In the notice, he stated: "The type of pavement to be used on the project will be determined by the Commissioner after bids have been received. The determination as to the type of pavement to be constructed will be made only after all factors, including costs, have been fully investigated."

Upon the opening of the bid it was found that on alternate A, calling for reinforced concrete, a contractor, S Co., was the lowest bidder. Plaintiff also bid on this alternate. On alternate B, calling for bituminous pavement, the plaintiff was the lowest bidder. In fact, this bid was the lowest of all bids received..

The Commissioner is about to award the contract to the S Co., and plaintiff asks for an injunction to prevent this, on the ground that the Connecticut statute requires the Commissioner to award the contract to the lowest bidder, if it is awarded at all. The statute in question reads as follows: "The Highway Commissioner shall have the right to reject any and all bids, if, in his opinion, cause shall exist therefor; but otherwise he shall award the contract to the lowest bidder whom he shall deem responsible".

The court held that this statute did not prevent the Highway Commissioner from selecting the higher-priced alternate. He had power to call for two independent sets of bids, and then to reject all bids in one set (e. g. bituminous concrete) and accept the lowest responsible bid in the other set (e.g. reinforced concrete). The mere fact that he formally joined the two sets of bids in a single notice to prospective bidders, providing for alternates, does not change this.

The court therefore refused the injunction. This is in accord with the great weight of authority, as shown by the Court's citations of authority.

The Mathematics of Sidewalk Liability

Parker v. City of Denver, 262 Pac. (2d) 553, decided Oct. 19, 1953, raised the question of whether an unevenness of less than two inches in a sidewalk can possibly cause liability for negligence on the part of a municipality, when someone is injured by tripping over the elevation.

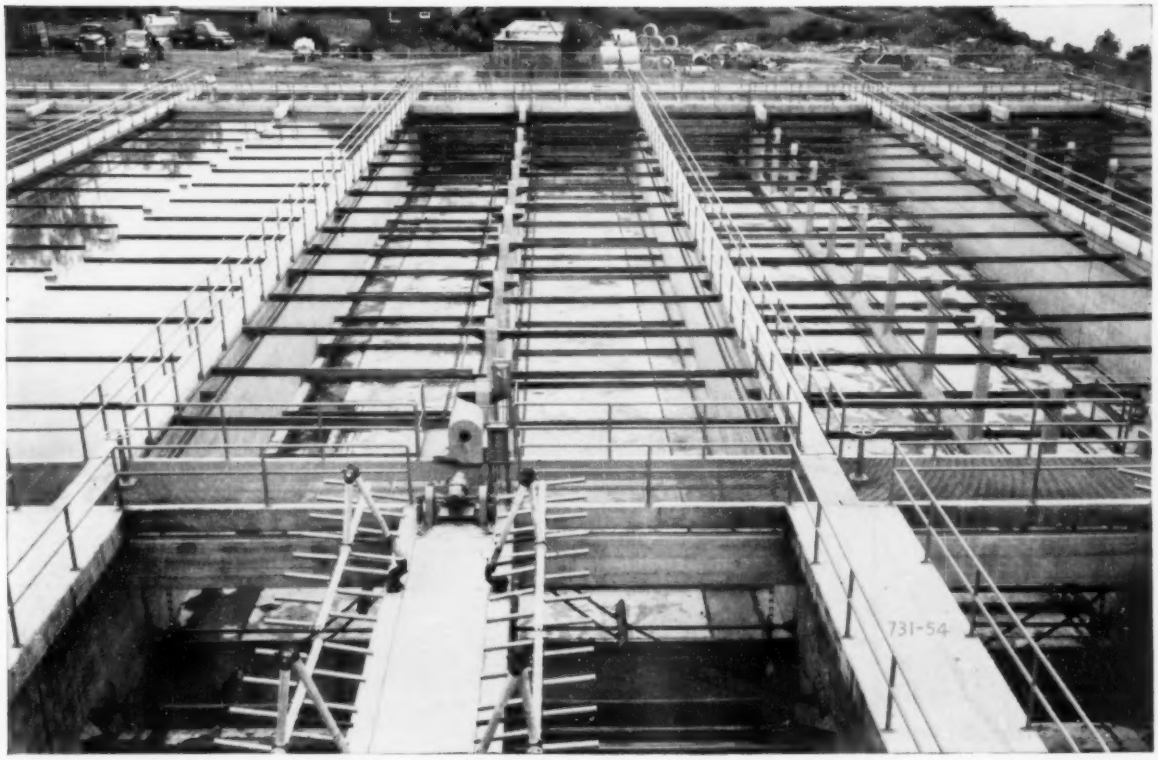
In this case the elevation in the sidewalk was between 1 and 2 inches high. The plaintiff tripped and fell, resulting in serious and permanent bodily injuries. In the lower court it was held as a matter of law that such a small elevation could not possibly constitute negligence, and a verdict was directed by the court in behalf of the city.

On appeal it was held that this was error,—that the question of whether or not this defect constituted negligence was a question of fact for the jury, and that there was no mathematical rule dividing negligent-type defects from non-negligent ones.

There is a great variety of opinion among the courts on this point. The cases on this subject are collected in 37 A.L.R. (2d) 1187 and in 119 A.L.R. (2d) 161.

It should be noted further that practically all (if not all) jurisdictions now agree that municipalities are liable for negligence in improperly maintaining sidewalks or streets. This is certainly not obvious as a matter of law, since such a duty

(*Continued on page* 84)



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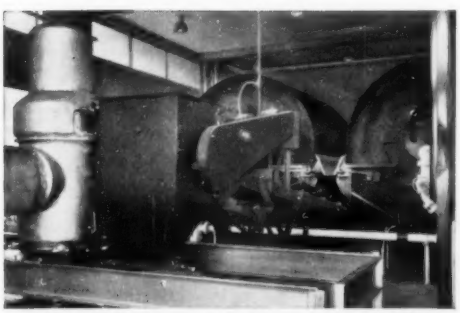
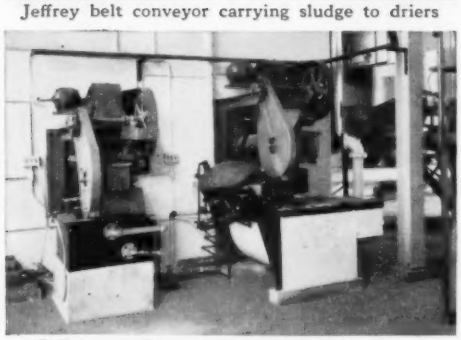


Jeffrey belt conveyor carrying sludge to driers



Jeffrey spiral conveyors handling coagulants

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would certainly seem to be governmental rather than proprietary. In most states, however, the liability of a municipality for such defects has long been established at common law, despite the fact that the rule is the reverse as regards maintenance of highways by State governments. In most (if not all) the states which originally held the municipality immune from liability in these cases, the rule has been changed by statute. Therefore, at the present time it is virtually a universal rule that municipalities are liable for negligently causing injuries through improper maintenance of sidewalks and streets.

Airports in Residential Zones

Aviation Services, Inc. and Town of Morristown v. Board of Adjustment of the Township of Hanover, 119 Atl. (2d) 761, a New Jersey case decided Jan. 9, 1956, raises the question whether a municipal airport is immune from the zoning ordinance of the township in which the airport is located.

The airport was built under statutory authority reading as follows: "The governing body of any municipality may acquire, establish, construct, own, control, lease, equip, improve, maintain, operate and regulate airports or landing fields for the use of airplanes and other aircraft within or without the limits of such municipality and may use for such purpose or purposes any property, owned or controlled by such municipality, suitable therefor."

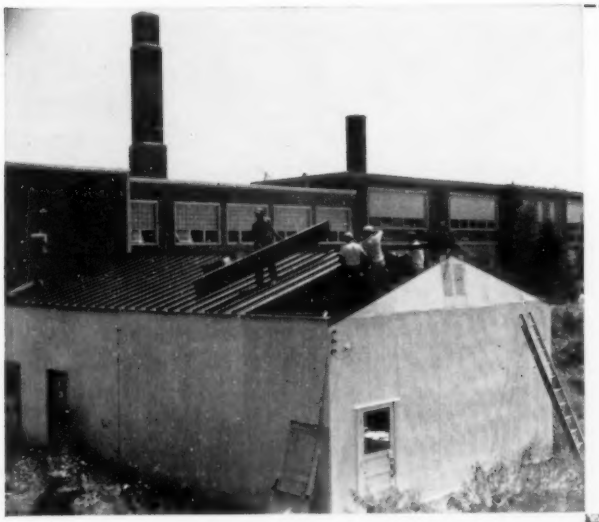
After the airport was built, the township classified the area in which it was located as a residential area. The present suit was by the municipality and a lessee from it, seeking a declaratory judgment holding the township's zoning ordinance to be inapplicable to the municipal airport.

The court held that the airport was immune from the operation of the zoning ordinance, basing this decision on the necessity for construing the statute cited above liberally, in order to effectuate its purpose.

• • •

Tower to Cool Hot Water for Domestic Use

The water drawn from wells at the Naval Air Depot at Hawthorne, Nev., has a temperature of about 120° F. A cooling tower was constructed of redwood slats, with two 8-ft. fans operated by 20-hp motors. This will cool 1,000 gpm from 120° to 77°.



SCHOOL TO GARAGE. In process of dismantling, this Armco Building had been used 7 years as a school. No longer needed, it was moved and re-erected to serve as a garage for school buses.

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The drought continued. Then, in a matter of weeks, 5½ million gallons of water a day were pouring into the area. The two cities and three oil refineries were saved. Co-operation—and Caterpillar power—had brought precious water all the way from the Arkansas River—in time.

In a unique joint project, officials of the cities of Augusta and El Dorado, and of the Skelly, El Dorado and Socony-Mobile refineries, formed the Augusta-El Dorado Water Association, employed a contractor to lay over 32 miles of 16″ and 18″ pipe, and built a pumping station on the Arkansas River. The pumping station, powered by three Cat Engines, has been running ever since September, 1954.

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PUBLIC WORKS MAGAZINE

JUNE 1956 VOL. 87, NO. 6

CALCIUM CHLORIDE

STABILIZATION AS RELATED TO SOILS BASES

H. F. CLEMMER,* Engineer of Tests and Materials,

Street Division, Department of Highways, District of Columbia

DURING THE past year the public has, as never before, become cognizant of the need for a greatly expanded highway program to provide the basis for a highway network to permit the efficient use of the millions of cars now registered in the United Sates. The recommendation by the Administration for the expenditure of one hundred and one billion dollars in the next ten years, has provided a great impetus to the development of a program of highway construction. The problem of financing is the deterrent to immediate adoption of a highway bill; however, it is believed this will be satisfactorily worked out so that Congress will present and approve a compromise bill in the immediate future to provide needed funds.

The greatly increased demand for roads has created a definite need for development of the most efficient and economical pavements possible. During the war years road construction was at such a low ebb that research and study as to design of pavements remained rather static. Some studies have been made as to a correlation of the design of pavements and their load carrying capacity, that is the legal load limit that should be permitted on pavements being constructed by the States under Federal Aid approval. Engineers are considering the spacing of joints, the thickness of pavement slabs, the value of reinforcement, and particularly the importance of constructing a satisfactory soils foundation. Advancement in the knowledge of soils for engineering purposes has made rapid and extensive advancement in the last few years and all highway engineers are fully appreciative of the importance of providing a well stabilized and compacted soils base on which to construct either a high type pavement or a secondary type surface. All engineering structures must depend upon an adequate foundation for support and this axiom certainly holds for the pavement slab. Without question less thickness of pavement surface is required when a uniform and dependable soils base is provided. A properly stabilized soils base may effect a saving by reducing the thickness of the required pavement surface.

Various specification writing organizations (ASTM, AASHO) have

*Chairman
H.R.B. Committee on "Soils Calcium Chloride Roads".
A.R.B.A. Committee on "Calcium Chloride Stabilization".

developed specifications for soils for highway construction which form a guide for the engineer to follow and, if followed, insure him of satisfactory results. Where suitable granular material is available, every consideration should be given to constructing a calcium chloride soils stabilized base.

A specification for calcium chloride stabilized soils for foundations for pavements should follow the same general principles as specifications for portland cement concrete. The material must be well graded and must follow a balanced proportioning of granular material and fines supplemented by the continued presence of moisture to maintain the cementing value of the fines. As with portland cement concrete, the least amount of cementing medium that will provide proper strength should be used. The use of calcium chloride in the soil permits a mixture with a low percentage of binder (material passing the 200 sieve) and a P.I. of 3 or less. The least amount of water (not in excess of optimum) should be used that will permit maximum density. The more dense the material the less probability of moisture penetrating into the soils base.

The A.A.S.H.O. presents the following specifications as to required gradations:

Sieve No.	*Percent Passing*
1 inch	100
$^3/_8$ inch	50-80
No. 4	35-65
No. 10	25-50
No. 40	15-30
No. 200	5-15

Consideration should be given to the durability of the aggregate. The fraction passing the No. 200 sieve should be less than one-half of the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve should have a liquid limit not greater than 25 and a plasticity index not greater than six.

The Plasticity Index, as the term implies, is merely a measure of the range in moisture content over which a soil will remain plastic and likewise cohesive. Plasticity Index is the numerical difference in moisture content of soil between the liquid limit (that is the percent of moisture at which the material flows) and the plastic limit (that is the lowest percent of moisture at which the soil will not crumble). The Plasticity Index is one of the most reliable physical properties on which to base selection of material for a soils base.

By use of the foregoing materials specification, and with proper construction, the Engineer is assured of a stable road. Broadly defined a stabilized road surface or base is one that will not flow laterally under load. This stability is obtained from two main factors—internal friction, and cohesion. Internal friction provides stability under excess moisture or wet weather conditions. Cohesion, due to moisture films, which surround the individual particles of material in the soils mixture, is the force which (in dry weather) binds the materials together and prevents ravelling. To develop this cohesion the presence of moisture as well as a certain amount of binder (the minute particles which carry the moisture films) are necessary.

Function of Calcium Chloride

It is the function of calcium chloride to maintain the moisture in the proper amount. Due to the deliquescent properties of calcium chloride it will absorb moisture from the air and release moisture to the soils in accordance with the prevailing conditions of humidity and temperature. Because a calcium chloride solution has a lower vapor pressure than plain water, the evaporation of the moisture from calcium chloride treated soils is controlled to a much greater degree than from one wetted with plain water. Calcium chloride, therefore, assists in conserving the moisture.

In a report presented by the H.R.B. Committee on "Soils Calcium Chloride Roads," it is stated that calcium chloride solutions provide thinner and stronger films than those of plain water. Therefore, the use of calcium chloride in soils will result in not only increased density but also in greater stability.

● **THE SPREADING and rolling of the granular material is very important in calcium chloride stabilization. This street is being built in a housing development.**

Moisture films exert tremendous bonding action, and the thinner the moisture film surrounding the clay particles the nearer it approaches solidified water and the greater the bonding action. An illustration of the stabilizing effect of this moisture film may be found in the beach sands at Daytona Beach, Florida. When the tide is out moisture films hold the sands in place so that heavy racing cars, which exert tremendous stresses at very high speeds, find a stable surface. However, when the tide is in, the moisture laden sand will not support the weight of a man. Due to the thinness of the calcium chloride solution membrane and its bonding properties, soil particles in the mixture are pulled closer together thus providing greater densities. Practical tests have shown that the same compaction after nine rollings of a plain water mixture may be obtained with only four rollings for a calcium chloride mixture.

The terms relating to the various parts of a soils foundation have been variously defined during the past years. Recently a joint committee of

ASCE and ASTM have recommended the following which it is believed do function to clarify:

Subgrade — The prepared and compacted soil below the pavement system.

Subbase—The layer used in the pavement system between the subgrade and base course.

Base—The layer used in a pavement system to reinforce and protect the subgrade or subbase.

It is necessary to have a satisfactory (uniform and well compacted) soils foundation throughout, that is —subgrade, subbase, and base, to insure against settlement of the soils or failure of the soils base. Special care should be used in constructing a soils base course when the pavement surface is to be placed promptly, as minor deficiencies in compaction cannot be easily corrected as in the case of an unsurfaced road. Many pavement failures, especially those occurring within the first year or so after construction, are the result of settlement or movement of the subgrade, the failure of the soils base due to segregation of aggregates during construction, or of insufficient density and stability. Replacement or repair of such failed sections will generally cost far more than an initial expenditure for a properly constructed soils foundation. In previous years it was the practice to build fills, etc., long in advance of pavement construction so as to permit consolidation and densification of the soils; however, with the demand for speed in construction, soils foundations must be properly constructed initially to provide against later settlement or volume changes. The depth of the soils base should be sufficient to provide distribution of the superimposed wheel load over an area large enough that the downward pressure will not exceed the bearing capacity of the underlying subbase and subgrade.

Plant Mixes

One of the most important factors in this construction of a soils base is that of "uniformity" and for this reason contractors and engineers have turned to a plant mix method of control. Though the control by this method is far superior to the so called road mix it is often found to be no greater in cost and in some cases the cost is less. Advantages of this method are:

(1) The mix is more uniform because the mixing is carried on at a central location which permits of maximum control.

(2) Segregation during loading and dumping is eliminated because the material is kept damp.

(3) Moisture content which is so vital in attaining density and stability is easily controlled and maintained.

(4) Maximum compaction may be attained due to uniformity of material and maintenance of moisture content.

(5) Inspection requires but one engineer at the mixing plant. He is able to control gradation of material, moisture content and the percent of calcium chloride.

Normally the coarse and fine aggregates are blended from separate bins onto a conveyor belt which carries the material to a pug mill. The calcium chloride is usually added with a vibrator or similar type feeder, directly onto the aggregate on the conveyor belt at the rate of 10 pounds per ton of material. The correct amount of water is added through spray bars located over the mixer.

The soils mixture is transported with trucks which circle from the plant to the job. It is preferable to spread the material with mechanical spreaders. Two spreaders should operate side by side covering the full construction width so that rolling may proceed immediately with a minimum loss of moisture in the material.

Although the value of plant mixed materials is generally recognized, it may prove more practical for many projects to construct a soils base or stabilized surface by road-mix methods. This method of construction requires more careful inspection and supervision to insure uniformity as the control of materials and moisture must be maintained in the field.

The subgrade and subbase must be in a thoroughly compacted condition and provided with adequate drainage prior to construction of the soils base.

To construct a satisfactory soils base by the road-mix method:

(1) The coarse and fine material should be placed on the prepared soils surface, care being taken to insure an even distribution of materials. A method of placement should be used that will prevent segregation.

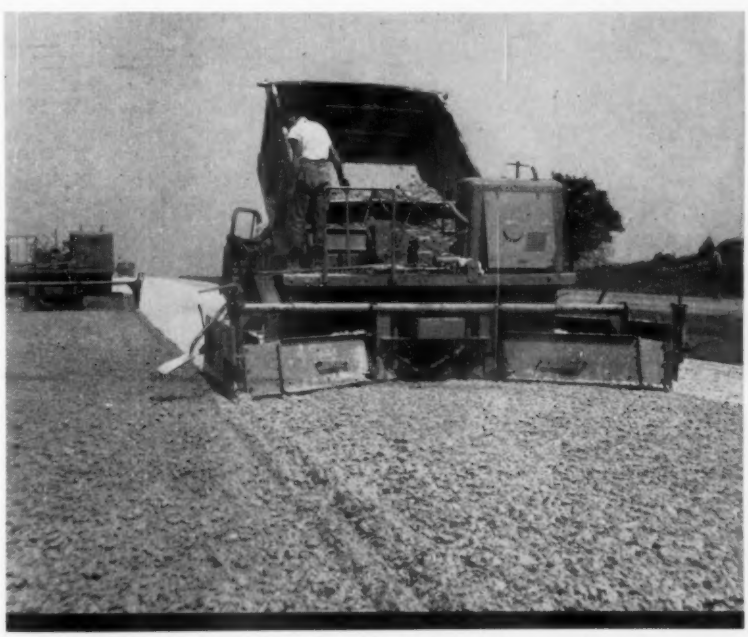
(2) Binder-soils should be in a dry and pulverized condition when placed.

(3) All the material should then be bladed by standard methods from side to side, with a patrol grader or mixed with a traveling mixing machine until it is thoroughly and uniformly mixed.

(4) Lifts should not exceed four inches of compacted thickness.

Aggregates should be dry mixed to some extent before the addition of the calcium chloride. Calcium chloride should then be added by means of a mechanical spreader at the rate of ½ pound per square yard per inch of compacted depth.

For both the plant mix and the road mix operations, the material



● **MECHANICAL spreaders operating side by side should cover the entire construction width so that rolling may start as soon as possible without loss of the moisture.**

should then be placed to the proper grade and crown. If the base is to be used as a surface for a period of time before placing the finished pavement, particular care must be taken to insure that not less than ⅜ inch per foot (preferably ½ inch) crown, to permit quick run-off, is provided.

Rolling should be accomplished by the use of 8-10 ton three wheeled rollers, pneumatic rollers or a combination of both. Vibrating compactors are also proving efficient for this purpose.

If practical the pavement surface should not be placed for a few days to permit the base to attain maximum stability.

As stated by Fred Burggraf, Director of the Highway Research Board, though satisfactory density may be obtained, maximum stability will not be attained until seasoning or drying has occurred. During this seasoning period the continued presence of free moisture to aid in consolidation of the soil mixture is essential. This period is a most important factor affecting the durability of the road, for unless sufficient free (lubricating) moisture is present to permit maximum compaction, the base will not have the desired wet weather stability. Calcium chloride controls the rate of moisture loss thereby permitting a greater density to be attained with the same compactive effort.

The incorporation of calcium chloride in the soils base will provide (1) greater ease of manipulation, since the mixing water does not evaporate to an inconvenient degree. (2) Greater density and cohesion, resulting in added strength per inch of depth. (3) Insurance against premature drying after completion with resultant added maintenance costs. (4) An apparent aid to the absorption of bituminous priming when applying a surface treatment.

As temperatures become lower and the water more viscous, there is an increase in the thickness of the film surrounding the binder particles and therefore, the attainment of maximum compaction is made more difficult. The incorporation of calcium chloride in the mix creates a thinner adsorptive film and facilitates compaction. The property of calcium chloride to lower optimum moisture content of soils results in the attainment of denser and more stable surfaces at all temperatures than similarly proportioned and compacted plain soils. Its use when construction is carried on during low temperatures is of particular value.

Large scale housing construction in urban areas has caused an increased demand for serviceable roads in the outlying areas of cities. Funds to meet the great demand for high type pavements are not always available so that other approaches to the problems are necessary. Stage construction using granular stabilized roads for the relatively light traffic initially encountered in these areas has proven most satisfactory, both from the first cost and maintenance standpoint. The practice in the District of Columbia consists in the construction by maintenance forces of an 8-inch calcium chloride treated bank run gravel stabilized roadway, maintained as a surface until any weak spots which may develop have been corrected. The base is placed so that a completed pavement will meet the desired grade.

The ideal plan is to contract for plant mix material, that is with all materials—aggregates, binder, calcium chloride and water—to be proportioned at the plant, properly mixed and delivered to the various streets to be surfaced. The control that is provided by this method insures uniform and maximum attainment of compaction and stability. Where either a rigid or flexible surface is to be placed rather promptly, this is of particular importance.

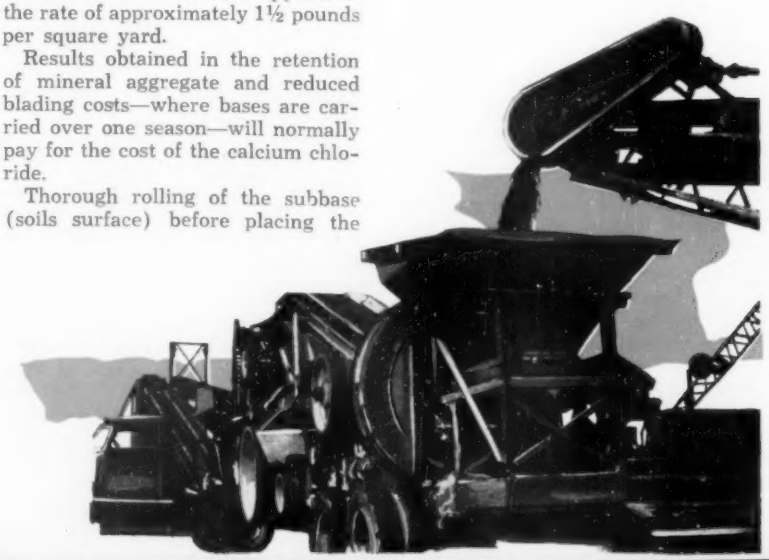
Where the project of plant mixed material may not be practicable, bank run gravel meeting specifications may be hauled directly to the streets to be constructed. The material, whether plant mix or road mixed, should be spread with suitable mechanical spreaders, or by tail-gating, if spreaders are not available. Calcium chloride should be used in the mix at rates previously described. When the base is to be maintained as an open surface, calcium chloride should be applied at the rate of approximately 1½ pounds per square yard.

Results obtained in the retention of mineral aggregate and reduced blading costs—where bases are carried over one season—will normally pay for the cost of the calcium chloride.

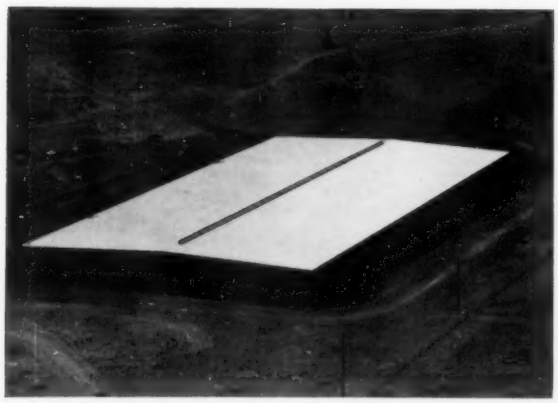
Thorough rolling of the subbase (soils surface) before placing the gravel is important in order to obtain proper compaction of the soils base. This rolling will assist in locating poorly backfilled utility trenches. Where such places are found the material should be removed and replaced with that material being used for surface. Thorough compaction must be attained and occasional density tests should be made to be sure the specification requirements are being met.

Strict compliance with material quality specifications is essential and a soils inspector should be maintained at the plant or gravel pit. A good inspector can readily acquire a "feel" for the materials and the deposit topography of the pit areas and this ability serves as a valuable supplement to his test data. Before placing a bituminous surface treatment or an asphaltic concrete surface, every precaution should be taken to insure a stable condition of the soils base. For minor repairs, it is advisable to maintain a stock pile of selected borrow material which has been treated with calcium chloride for maximum compaction with minimum effort. This method of construction has several distinct advantages: economy of construction, the opportunity of correcting any unsatisfactory subgrade conditions prior to construction of a high type surface, and providing an excellent base which will reduce the design requirements for any future permanent type pavement contemplated. Prompt and efficient maintenance of this type of roadway determines, to a large degree, the success of such a program.

With the construction of a curb and gutter section and the placing of at least a one-inch compacted asphaltic concrete, a most satisfactory residential pavement is provided—one that is certainly economical in construction cost.



● **AGGREGATES, calcium chloride and water can be pre-mixed at the plant.**



● **AERIAL view of the 5¼ acre aluminum cover on the Las Vegas Valley Water District's 30 million gallon reservoir.**

● **ROOFING sheets supplied by Kaiser Aluminum & Chemical Corp. are .024 gauge, 48 ins. wide and 8 or 10 ft. long.**

ALUMINUM COVER

PROTECTS WATER WORKS RESERVOIR

FOR PROTECTING Las Vegas' stored water supply from dust and the hot desert sun, 5¼ acres of aluminum sheeting are used. The covering was specified for the Las Vegas Valley Water District's new 30-million gallon Charleston Heights Reservoir to keep out both dust and sunlight. The cover prevents the growth of algae and, in turn, cuts down on the amount of chemical necessary for treatment. Aluminum lent itself particularly well to this application because of its excellent heat reflecting qualities, its resistance to corrosion, which made painting unnecessary, and its light weight.

The reservoir is of the earth embankment type with an asphalt lining. It is divided into two basins of equal size, 336 feet square. Total area covered was 229,500 square feet. The roofing sheets, supplied by Kaiser Aluminum & Chemical Corporation, are standard corrugated aluminum roofing sheets, 0.024-gauge, 48 inches wide and in 8 and 10-foot lengths. More than 100,000 pounds of the material were required.

The cover was designed to withstand wind loads of 12 pounds per square foot horizontally and 15 pounds per square foot against vertical surfaces. The aluminum sheets were fastened to 6½-inch galvanized steel I-beam purlins with straw nails with neoprene washers under the heads. Two straw nails were used at every third corrugation at eave purlins and at end laps. One straw nail was used at every third corrugation at intermediate purlins. End laps were sealed with mastic. Purlins are spaced on 36-inch centers and span 26 feet between tapered steel girders. The girders are supported by 4 and 6-inch standard steel pipe columns.

In addition to the roof, aluminum sheeting was used to cover a 600-foot monitor type ridge vent running the length of the reservoir. The structure is also vented by continuous 12-inch side eave vents on the eastern and western sides.

The $617,037 reservoir is part of the Las Vegas Valley Water District's current $5½-million program to add 13¾-million gallons per day to the district's former water supply of 21 million gallons per day. Prior to the new system, Las Vegas was wholly dependent upon well water and had a storage capacity of only 4 million gallons, or sufficient for only about 4 hours on a peak day.

Under the new system, water is pumped from Lake Mead, a distance of 25 miles, with a lift of approximately 1,000 feet, to the Charleston Heights Reservoir west of Las Vegas. The Lake Mead water will bring the district's total capacity to approximately 35 million gallons per day, including ground water rights in the process of being perfected.

The new water supply system, including the reservoir, was designed by James K. Montgomery, consulting engineer, of Pasadena, California; R. C. Kenmir is chief engineer for the firm, and Harwood Jones was resident engineer throughout construction. William C. Renshaw is General Manager of the Las Vegas Valley Water District. Prime contractor for the cover was Lembke-Clough and King of Las Vegas. The aluminum was applied by Taylor Steel Company, also of Las Vegas.

● **CORRUGATED aluminum sheets are secured to steel I-beam purlins. More than 100,000 pounds of standard roofing sheets were used on the job.**

● DAYTIME view of heavily traveled NW Seventh Street.

● NIGHT view of NW Seventh St., showing fine lighting.

NEW LIGHTS ENHANCE MIAMI THOROUGHFARES

ERNEST A. FORT
Director, Dept. of Public Service
Miami, Florida

THE MAGIC City of Miami, with its 35 square miles of land area and 750 miles of improved streets and highways, has embarked on a long range project to re-light and modernize its street lighting. Good street lighting design and engineering requires the utmost cooperation of many interested groups, especially in Miami where the population has doubled in just a few short years. There is no magical formula to obtain the ideal of traffic safety, accident and crime prevention, except civic pride, in this newest metropolitan area of the South.

Miami has simplified the complexities of an improved street lighting program by dividing the problems into three areas of responsibility. These are (1) Residential; (2) business; and (3) thoroughfares.

Residential street lighting improvement has for its goal in Miami the elimination of "fearways" and reduction of crime. The Power Company has undertaken a section-by-section modernization of the existing residential street lights, raising the lighting values to 2500 and 4000 lumens per unit. Progress in this direction has been rapid and now over a third of the City's residential area has been modernized and improved.

Miami's downtown business district lighting has not been modernized in the last 25 years, except for increasing the lumens of the incandescent light installations. Mercury vapor lights have been ordered to replace incandescent lights on North 5th Street, from West 7th Avenue east to Biscayne Boulevard. This is a heavily travelled street along the north side of the immediate downtown business district. Mercury vapor lights are already installed in one of our more recent shopping centers just north of N. E. 79th Street and west of Biscayne Boulevard.

The newer street lighting improvements have been made on the "through-ways" or main traffic arteries connecting business centers, rather than in downtown Miami, which already has a high level of illumination.

The City Public Service Department is endeavoring to increase traffic safety through improved arterial highway lighting on its major thoroughfares. This segment of the street lighting program must, of necessity, be carefully coordinated with the re-paving and widening of streets and highways by State, County and Municipal agencies. Twenty miles of newly paved streets have already been relighted with some 1300 luminaires, some with 10,000 lumen incandescent lights and others with 20,000 lumen mercury vapor lights. Of course Miami, a city of over a quarter million people, still has a big job ahead in street lighting and in other types of improvements.

Because of just one phase of Miami's street lighting modernization program, millions of television viewers across the nation get a clearer look at the famous Orange Bowl parade each New Year's Eve.

Eight blocks of Biscayne Boulevard, an arterial highway which widens to 12 lanes in the downtown area, is only one of several street lighting modernizations of recent years. This section of the boulevard, previously illuminated at parade time by temporary flood lighting, now is lighted by 48 incandescent 25,000 lumen lamps mounted 28 feet above the pavement. Brackets extend the lamps eight feet toward the center line. Illumination on the street surface has been improved 300 percent. Experience has since shown that the heavy traffic flow along this section has been safely speeded up to a remarkable degree.

However, 61 mercury vapor street lights of 20,000 lumens each have been installed on the Miami section of MacArthur Causeway, a heavily travelled road connecting to Miami Beach. Most recent Miami street lighting renovation is the improvement of Northwest 7th Street from 12th to 42nd Avenues, newest whiteway, completed in 1955. This street leads to the Orange Bowl Stadium and on football nights or when other attractions are held in the Bowl, this street is jammed from curb to curb with traffic.

In addition to repaving and widening the thoroughfare, it was equipped with incandescent luminaires of 10,000 lumens. These are mounted on steel poles spaced at 65-foot intervals in a staggered arrangement for a distance of three miles.

Perhaps the biggest of the throughway projects was the whiteway lighting of Northwest and Southwest 27th Avenue, which is the main traffic artery leading into the western part of Miami from the north. Now repaved, relighted and widened as far south as South Dixie Highway (U. S. Highway No. 1) it accommodates a heavy flow of incoming traffic from the north that can by-pass the downtown business section and again join U. S. Highway No. 1 on the route to Key West and other parts of South Florida and vice versa.

It was necessary to put luminaires in the center of the traffic stream, with turn-outs designed for cars going left off the boulevard where signal lights permit. This problem was solved by staggering the position of the luminaires, so as to conform to the shape of the center traffic islands. Now some 280 new double bracket steel poles are spaced at 85-foot intervals. The poles are 28 feet high, and the brackets extend eight feet toward the center line over each lane. Single bracket standards were added at intersections where needed. Incandescent luminaires of 10,000 lumens are used throughout.

Methods of financing the initial installation of new lights, as well as methods for meeting the annual operating costs, are being explored by Public Service Director, Ernest A. Fort and William H. Scovell, Budget Administrator, with the assistance of the City Engineering Department.

As in all rapidly growing metropolitan areas, street lighting is so much a part of good traffic planning that many of the streets involved in the street light improvement program must wait for the adoption of a coordinated master traffic plan. Economy being the keystone of all public service activities, it is naturally foremost in the minds of those working to achieve a future reputation for Miami as one of the better lighted cities in the world.

Lighting techniques have moved forward wth increasing speed in these post-war years and naturally while the street lighting engineer must be conscious of the tools now available to him, he must also be ever anticipating the new developments in street lighting which are now in the more or less experimental stage.

An installation now in progress is the changing of 4,000-lumen incandescent lights on North 36th Street from West City Limits to Biscayne Boulevard to 20,000-lumen mercury vapor lights. The same wood poles are being used but the light brackets are being raised to 28 feet above street level. This street is designated as U. S. Highway No. 27. It traverses the central part of Florida. This installation is for 110 lights over a distance of four miles. Lights are placed on the south side of the street only.

City officials remark that street lighting modernization in Miami has increased traffic safety in a city where drivers from all 48 states and many foreign countries are thrown together every year. Civic pride in tourist-conscious Miami has also been an important motivating force in improving street lighting, as have commercial considerations. City fathers agree their modern illumination promotes sales, helps merchants and, as has been proven in other cities, reduces burglaries, robberies, juvenile delinquency and other forms of night crime.

● **DAYTIME view of W. 27th Ave., showing staggered position of luminaires necessary to conform to traffic islands.**

● **NIGHT view of W. 27th Ave.; 280 double bracket steel poles are spaced at 85-ft. intervals, giving good lighting.**

FLUORIDATION and the COURTS

JAMES A. TOBEY,
Dr. P.H., LL.D.,
Member of the New York Bar

PROPER FLUORIDATION of public water supplies does not infringe the constitutional rights of individual citizens. This principle is now well-established in American jurisprudence. Between 1953 and the end of 1955 the Supreme Court of the United States and the courts of last resort in six states have ruled that this procedure is a valid and reasonable exercise of the police power of the State in the interests of the public health, and that it does not violate any of the rights of individuals vested in them by the Federal and State constitutions.

The addition of suitable fluorine compounds to certain municipal water supplies was first advocated in 1945. Adequate preliminary investigation had shown that a fluorine content of 1 part per million, more or less, in drinking water was a desirable measure for the prevention and control of dental caries in young, growing children, and that its beneficial effects apparently were carried over into adult life. The process was adopted in that year in a number of American communities, and in 1955 was in force in more than 1000.

Ten years of experience with fluoridation has conclusively demonstrated that this process reduces dental disease in young children, without any deleterious effects whatever. In some age groups and in certain areas this reduction has amounted to as much as 66 percent, while in other instances it has been somewhat less, but sufficiently great to be a most important contribution to the public health and general welfare.

In many parts of the United States the natural fluorine content of local water supplies often far exceeds 1 ppm, ranging from 2 or 3 to as much as 8 ppm. It is estimated, in fact, that about 5 percent of the American population, particularly in parts of the Southwest, has been consuming water high in fluorine for many years, without demonstrable harm, except some mottling of the enamel in the teeth of children. In many other sections of the country, local water supplies are low or lacking in fluorine. Adjustment of the content of this element to about 1 ppm is, therefore, merely the restoration of a natural constituent of water to its optimal level.

Despite the fact that there is now a very extensive scientific literature on this subject, and the process has been endorsed by government agencies and by numerous reputable medical, dental, engineering, and other scientific organizations, considerable opposition to fluoridation has arisen. Antagonism to any new and progressive development seems, in fact, to be characteristic of American minority groups. At one time there was much hostility to the addition of chlorine to water supplies for public health protection, but this process has been upheld by the courts,[1] and the opponents of fluoridation now concede that chlorination is proper.

Most of the opposition to fluoridation has come from the adherents of religious sects which espouse faith healing, from cultists and faddists, and from persons who have been deluded by the specious arguments against this meritorious process. The courts, however, have refused to permit these minority factions to dictate to the great majority in such an important public health matter. Having failed to upset fluoridation by court action, the opponents have turned to popular referendums, and occasionally have been successful. In one recent election in a city where fluoridation had been approved by popular vote a year previously, the proposition that "fluoridation be not continued" appeared on the ballot. An affirmative vote meant that the procedure would be discontinued. In the resulting confusion, plus the general apathy of the voters, fluoridation was defeated by a handful of votes, and this city was deprived of a beneficial process.

The opposition to fluoridation has given rise to considerable litigation. Practically all of it follows the same pattern, has presented the same arguments, and apparently has been nationally stimulated by well-financed bodies. The first court decisions were reported in 1952, when trial courts in San Diego, California; Baltimore, Maryland; Northhampton, Massachusetts; Fargo, North Dakota; and Chehalis, Washington handed down decisions upholding fluoridation of public water supplies in those communities. In the following year, there were similar favorable decisions by trial courts in

(*Continued on page* 172)

● **FIVE MULTI-LUBER pumps automatically service sixty bearings in this collection vehicle, owned by City of Detroit.**

Automatic Lubrication FOR CITY VEHICLES

CARL H. GUIDER
Superintendent, Division of Motor Transportation
Department of Public Works
Detroit, Michigan

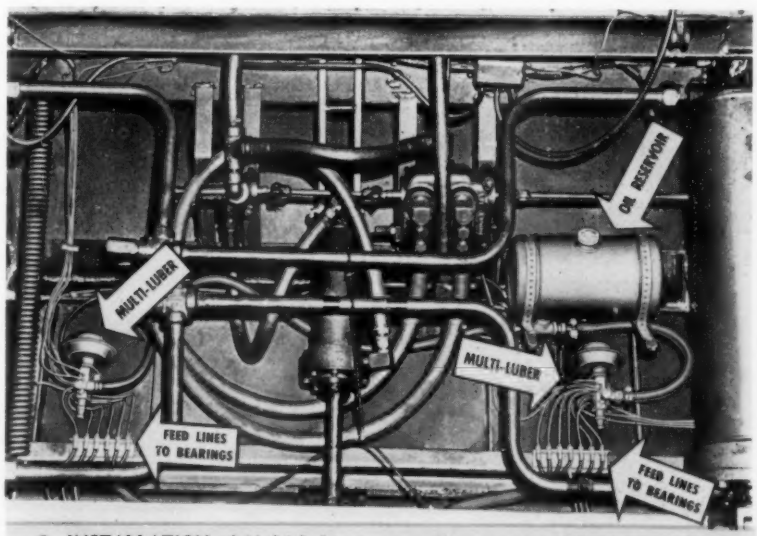
THE DIVISION of Motor Transport of the City of Detroit operates approximately 3,000 vehicles, not including those of the Departments of Fire or Street Railways. Maintenance and repair of these vehicles is a sizable operation and one which constantly commands our attention and best efforts towards reduction in costs. Every time we adopt an idea or a product which will prolong the life of our equipment, decrease down time or reduce the amount of time needed to service and maintain it, we save the taxpayers money.

Because of the type of service in which they are used and their complicated design, our closed garbage and rubbish trucks, known as Load-Packers, are our most costly vehicles to maintain. We operate over 500 of them, 95 percent being Gar Wood. There are over 60 bearings on the truck chassis and the Load-Packer body and we have found it very difficult to have them properly lubricated. Some of the bearings are in locations which are quite difficult to reach. The net result is that several points are not cared for regularly and others are skipped entirely. Consequently, we have worn parts, frozen joints, breakdowns and road delays. Aside from this is the fact that the unit is tied up approximately four hours every time it is lubricated and it takes two well trained men to do the job.

When automatic lubrication, known as Multi-Luber, which is manufactured by the Lincoln Engineering Company of St. Louis, Missouri, was brought to our attention about two years ago, we were particularly interested. We were given the names of a hundred or more large fleet operators in the United States who are users of the system and we contacted several to learn of their experiences. In every case we received favorable reports about increased life of equipment, lower cost of maintenance, easier steering, no bearing wear and other desirable results.

It was then that we decided to try out this Multi-Luber lubrication system on a Load-Packer truck

(*Continued on page* 185)



● **INSTALLATION of Multi-Luber pumps, oil reservoir and feed lines. Each pump lubricates twelve bearings; may be operated at fixed times or manually.**

M. A. CHURCHILL,

Chief, Stream Pollution Control Section,

Tennessee Valley Authority

HOW MUCH POLLUTION

STREAM STUDIES are made to establish a mathematical relationship between the pollution load put into the stream and the resulting decrease in DO in the stream. Once this relationship is established for a range of pollution loads, water temperatures, and stream flows, the extent of necessary treatment is obvious. The objective of the procedures discussed here is to develop such a mathematical relationship from observations on the stream itself.

The decrease in DO concentrations, from a point in the stream just upstream from pollution to the low point on the oxygen sag, is related in some way to (1) the quantity of pollution introduced, (2) the temperature of the river water, and (3) the amount of flow in the stream available for dilution of the pollution. Therefore: The extent of the DO decrease, or drop equals f(BOD, temperature, stream flow).

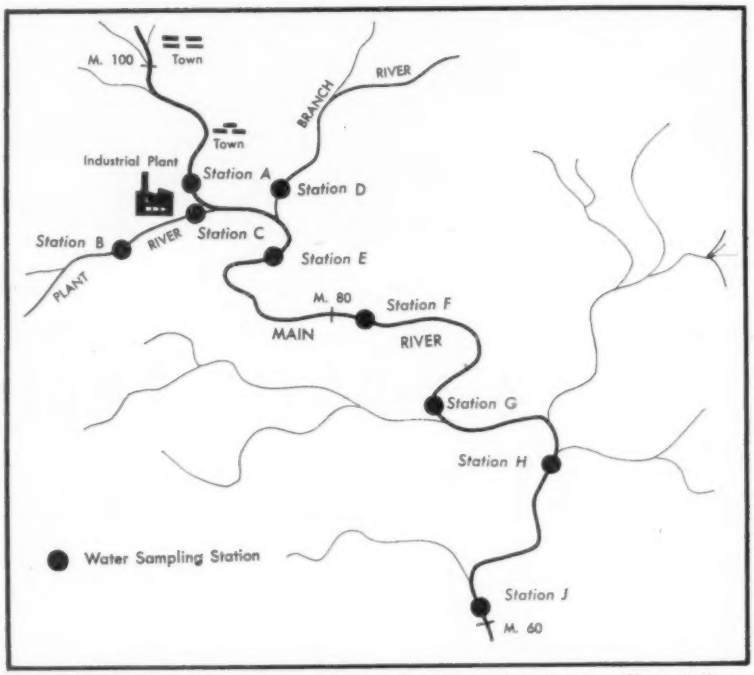
When a change in the value of one of the items on the right side of this equation produces a change in the value of the DO drop, it can be said that a correlation exists between these two factors. Since all of the factors on the right affect DO drop, a condition of multiple correlation exists. The simplest type of multiple correlation relationship is expressed by the linear equation

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 \quad (1)$$

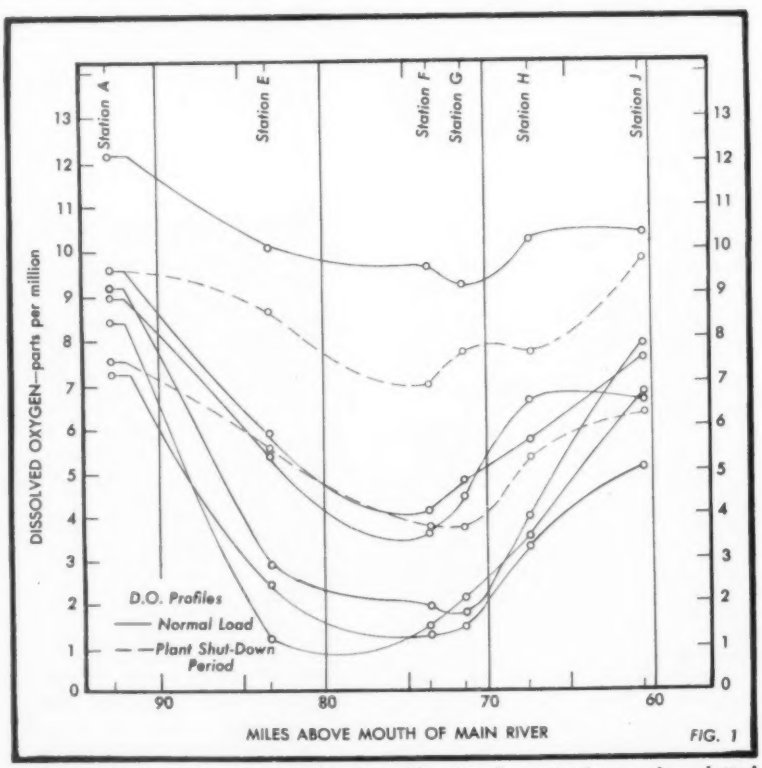
In which, Y = the dependent variable, DO drop, in ppm;
X_1 = 5-day BOD (Biochemical Oxygen Demand) in ppm;
X_2 = water temperature in °C;
X_3 = stream discharge factor; and
a, b_1, b_2, b_3 = constants derived from the data actually used.

Observations made by technical personnel of an industry located in the Tennessee Valley can be used to illustrate the development of the predicting equations necessary to the analysis of a particular pollution problem. Of special interest in this regard is the fact that undoubtedly many other similar sets of data exist over the country that can now be analyzed by the proposed method to determine how much treatment is really needed.

The DO sag curves, or profiles, of Fig. 1 show typical effects on DO of a relatively heavy load of pollution. Dissolved oxygen concentrations



● MAIN RIVER drainage basin, showing locations of water sampling stations.



● SELECTED examples of observed D.O. profiles show low point in sag when plotted.

CAN A STREAM ASSIMILATE?

were determined at each sampling station, BOD samples were collected and temperature observations made. In addition, discharges at each station were estimated from records of a gage at Station E, and from records at gages on several local tributaries to Main River. The profiles shown include observations made at intervals during a period of about a year, with the majority of data being obtained during the warmer months.

The source of pollution in the case illustrated is an industrial plant, the operation of which involves batch dumping of wastes. As a result, the BOD load to the stream is extremely variable on an hour-to-hour and day-to-day basis. The maximum observed rate of pollution loading just below the plant was 62,800 pounds per day of 5-day BOD, and the minimum observed was 9,600 pounds per day. Stream flows on the days of sampling varied at Station F from a high of 957 cfs to a low of 310 cfs. Water temperatures varied from 23.3°C down to 2.0°C. DO drop values varied from a maximum of 9.0 ppm to a minimum of 2.4 ppm on the 24 days of sampling. DO drop is measured as the difference between the DO concentration as observed at Station A above pollution, and the value read off the plotted DO profile of Fig. 1 at the bottom of the sag. The low value on the profile is not a direct observation since finding the low point of the sag would involve use of a boat and considerable sampling up and down the river. Instead, the DO profiles are drawn between actual observations as indicated in Fig. 1. If a sampling station can be located near the usual location of the low point of the oxygen sag as it occurs at low flows, accuracy will be improved.

Although the DO drop values are taken as the drop to the sag, no sampling station exists at the low point of the sag from which to obtain needed values of BOD in ppm, water temperatures, and stream discharges. Therefore, values of these variables as observed at Station F were used in the calculations. Trial has demonstrated that values of these so-called independent variables can be used as observed at any station along the low section of the sag curve. In this case, better correlation was obtained with data from Station F than from Station E, so the data at F were used.

In the multiple correlation procedure, each observation is included in the calculations in such a way that the resulting predicting equation derived from all observations will be the most accurate possible for the form of the equation selected. This is true because the least squares procedure used for fitting the equation to the data results in an equation such that the sum of the squared deviations of the observed values from corresponding values computed by the derived formula, is a mathematical minimum.

In order to apply the least squares principle, it is necessary to use deviations of each observation from the mean value of the variable considered. Therefore, if deviations from means are used instead of observed values themselves, the basic equation can be written:

$$y = b_1x_1 + b_2x_2 + b_3x_3 \quad \ldots\ldots\ldots (2)$$

In this equation the lower-case y and x values are used to indicate deviations from observed mean values. The b's are the same as those used in Equation (1).

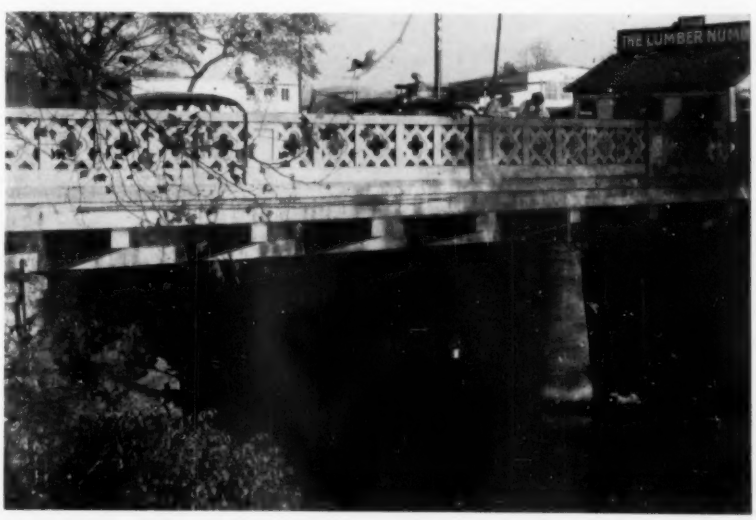
By using standard mathematical procedures, three so-called "normal" equations can be written down directly from Equation (2). Into these equations are inserted appropriate values of sums of squares of deviations and sums of cross products of deviations. The three normal equations are then solved simultaneously by a short-cut procedure known as the Doolittle Method and the three desired b values result. For the illustrative case discussed here, $b_1 = +0.480$; $b_2 = +0.208$; and $b_3 = +0.044$. The value of "a" in Equation (1) is computed directly from the mean values of each of the variables combined with the three b values just obtained. Its value here is -1.665.

It is now possible to write down Equation (1) in its final form; expressing the DO drop in ppm:

$$\text{DO drop, ppm} = -1.665 + 0.480\ (\text{BOD}) + 0.208\ (\text{Temp.}) + 0.044\ (10{,}000/\text{cfs}) \quad \ldots\ldots\ldots (3)$$

It will be noted the discharge factor is expressed, not as discharge directly but as 10,000 divided by the discharge. This is done because it has been found by experience that DO drop varies in a linear way with the reciprocal of discharge. The value 10,000 is used in the numerator simply to yield values of convenient size for calculation. Any other number could have been used since the value 10,000 is entirely arbitrary. Values of 10,000/cfs were computed for each observation and used in deriving the constants of Equation (3).

The derived equation can now be tested for performance by inserting in it sets of observed independent variables and solving for the value of DO drop. Fig. 2 shows values of DO drop, both observed and computed, for each set of independent variables. Seven of the 24 computed



● **BRIDGES assist sampling program. Here sample is taken from center of stream.**

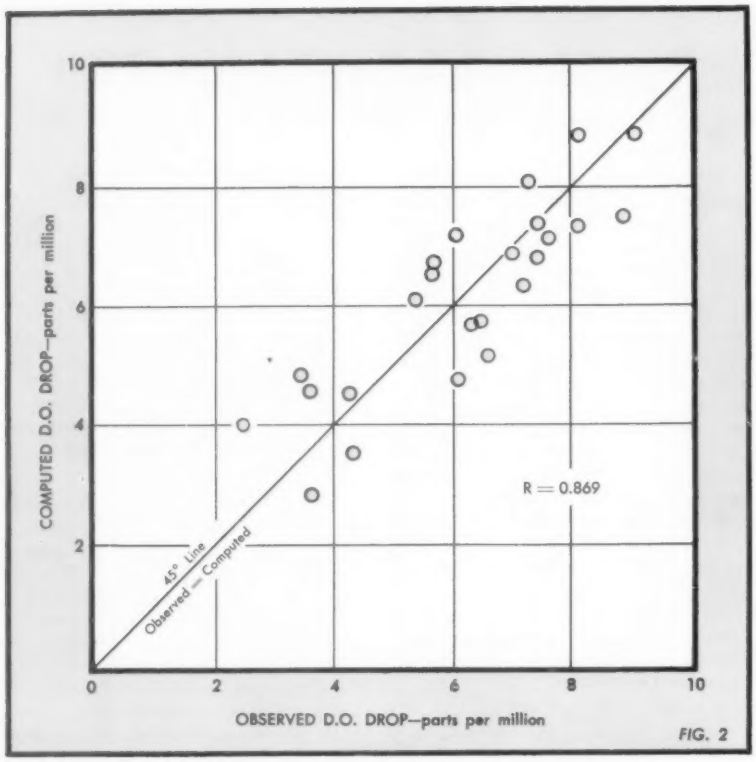


FIG. 2

● OBSERVED vs. COMPUTED D.O. drop—upstream of pollution to low point of sag.

values agree within 0.5 ppm of the observed values; 17 of the computed values agree within 1.0 ppm; 23 agree within 1.5 ppm; and the maximum difference is 1.6 ppm. Keeping in mind the erratic nature of the load, the agreement is quite good. It is apparent, therefore, that the major controlling influences, as regards DO drop, have been included in the correlation. It should be noted that time of water travel was not measured and of course was not used in the calculations. No calculations to determine reaeration are needed because the DO drop to the sag includes the net effect of deoxygenation and reaeration. No long-term BOD curves need be analyzed for the BOD constants k_1 and L.

Bottom Deposits Effects

When organic pollution is discharged to a stream some of the material settles to the bottom to form sludge deposits. In addition, bacterial and fungal slimes grow well on the bottom of the stream inasmuch as the waste material is a source of food supply. Some organic material is absorbed by these slimes, and some simply adsorbs onto them. As a net result of all the organic material on the stream bed, a significant demand is exerted on the flowing oxygen supply. This demand, of course, is in addition to the flowing BOD. There is no direct way of measuring the oxygen demand of all the bottom material. Measuring the BOD of the settleable solids in the waste is only a gross approximation since even if all these solids were removed from the waste there would still be an appreciable bottom demand due to suspended and dissolved organic material held in and on the slimes. A trickling filter, for example, is dosed with no settleable solids, theoretically at least, and yet as much or more BOD is removed by a standard rate filter as by primary sedimentation in normal sewage treatment practice.

Clean streams, i.e., streams having no added pollution as such, will usually be found to have a 5-day BOD of about 1 ppm. Such is the case for the clean streams tributary to Main River in this discussion. Therefore, if there were no bottom deposits and no added pollution, there would be no DO sag through the reach under study. By inserting 1 ppm BOD in the DO drop formula, and reasonable values for the other variables, we should compute no DO drop if no bottom demands existed. However, we find that when we solve the formula for these conditions we get a substantial drop. This computed drop must be due to bottom deposits, (and immediate oxygen demand). For example,

$$\text{DO Drop} = -1.665 + 0.480(1.0) + 0.208(25) + 0.044(10{,}000/280) = 5.59 \text{ ppm} \quad (4)$$

Thus the DO drop for conditions of no added pollution, for 25°C and for a minimum flow (once-in-10-years minimum daily) is computed to be 5.59 ppm. This may seem too great but fortunately there is a way to check on it independently. Industrial Plant was shut down for a period of two days prior to two of the observations made on Main River. In two days, at moderate or greater flows, practically all of the added pollution from Industrial Plant that will move with the flow has a chance to be carried out of the reach above the low point on the sag. This distance is not more than about 20 river miles. On these two occasions the observed DO drop values were 2.4 and 3.5 ppm. Flows were 515 and 500 cfs, respectively, and temperatures were 18.5°C and 21.5°C. Computed DO drop values (by the above procedure) for these two occasions, due to bottom deposits, were 3.5 and 4.2 ppm, respectively. Keeping in mind that oxygen demands are greatest when the deposits are the freshest, it is reasonable to conclude that the formula will yield close approximations of the DO drop due to bottom deposits.

The determination of the DO drop due to bottom material is important because this drop is a significant part of the total drop in many cases. Furthermore, bottom materials continue to exert a demand for a relatively long time.

Reduced Load Conditions

One of the most important uses of the DO drop formula is its use in calculating how much reduction must be made in the load at the source to keep DO values in the stream from going below a prescribed minimum value. Therefore, it is necessary to relate the BOD at Station F to the BOD at the source. This is so because it is the BOD at F that is used in the formula, and not the BOD at the source. The question immediately arises, why was not the BOD just below the source of pollution used in the DO drop formula in place of the BOD at F? The answer is, that in this particular case the load is so erratic with respect to time that a very poor correlation would be obtained if the load at the source were used. The load just below the source might be very low and yet at Station F the effects of a heavy slug of earlier pollution might

be sampled. This would seem to argue in favor of determining the time of flow in order to get consistent data. It is no doubt true that this would improve the correlation. Of even more importance, however, is the fact that if times of water travel had to be determined and then each of the samples had to be collected in accordance with the findings to give the proper lag time to each station, the chances are very good that the management of Industrial Plant would have decided against taking any samples at all. As it is, the samples were collected and with the aid of statistical methods, can be used for stream analysis.

Two methods are discussed below for relating the measured load at F to the load at the source. The simpler of the two will be given first.

The Method of Proportions—Streams have a really amazing ability to reduce by natural processes the pollution loads put into them. Main River is no exception. The mean pollution loads as observed at the various sampling stations are shown in Table 1. Station C is located on a small tributary to Main River just below Industrial Plant and only a short distance above the mouth of the tributary where it empties into Main River. There is a small amount of residual upstream pollution sampled at Station A on Main River. Station A is located just upstream from the tributary carrying the load of Industrial Plant.

From Table 1 it will be noted that the total added load of 34,350 pounds per day at Station A plus C is reduced to 14,980 pounds by the time Station F is reached, some 20 miles downstream. This reduction is 56.4 percent. Since this is the reduction in the mean measured load, it is reasonable to assume that if the load were reduced at the source, the stream would reduce this reduced load by 56.4 percent in the same river reach. On this basis the load at F is related to the load at the source. An example will help in the understanding of its application. Table II shows the load reduction at minimum flows.

The added load at Station A in Table II is unchanged from that shown in Table 1 since this is the residual load from upstream on Main River. The added load at Station C is taken as half of the measured mean added load at this station, thus making the total added load below both stations 17,850 pounds per day.

According to the proportion theory discussed above, this load will be reduced 56.4 percent by natural processes by the time it reaches Station F. After this reduction, the load at F will be 7,780 pounds per day.

For illustrative purposes, assume this load will occur in a minimum flow of 280 cfs. This is the flow that is consistent with 150 cfs at Station A. Along with this added load there will be the natural load, at 1 ppm, of 1510 pounds per day. The total load

Table I—Natural and Added Pollution Loads

Location	Average flow on Sampling Days cfs	BOD Load (lb/day) Natural at 1 ppm	BOD Load (lb/day) Measured Mean	BOD Load (lb/day) Added
Station A	300	1,620	2,970	1,350
Station C	71	380	33,380	33,000
Total A and C				34,350
Station E	487	2,630	24,830	22,200
Station F	526	2,840	17,820	14,980
Station G	565	3,050	17,580	14,530
Station H	756	4,080	16,130	12,050
Station J	831	4,490	14,680	10,190

Table II—For 50 Percent Load Reduction at Industrial Plant with Minimum Flow

Location	Discharge cfs	BOD Load (lbs/day) Natural at 1 ppm	BOD Load (lbs/day) Added
Station A	150	810	1,350
Station C	30	160	16,500
Total A and C	180	970	17,850

● **TEMPORARY staff gauge and water level recorder can be installed economically to give essential knowledge of stream flow.**

● WATER SAMPLES are collected from a boat where bridges are not conveniently located. Line across river helps space samples.

at Station F will, therefore, be 7,780 plus 1,510 or 9,290 pounds per day. Converting this total load to ppm at F for use in the DO drop formula, a value of 6.14 ppm is obtained for the BOD concentration at F. Solving the DO drop formula with a BOD of 6.14 ppm, a temperature of 25°C, and a discharge of 280 cfs, gives a computed DO drop from A to F of 8.06 ppm. The 8.06 ppm value is the drop computed with the formula derived from normal load conditions, and thus the 8.06 value includes a normal bottom deposit effect of 5.59 ppm, as computed by Equation (4). The difference between 8.06 ppm and 5.59 ppm, or 2.47 ppm, must be due to suspended and dissolved BOD under 50 percent load conditions. Since there is no possible way of computing what the reduced bottom effects on DO will be, a simple assumption is made that seems reasonable. The assumption is that bottom effects on DO will be reduced in direct proportion to the reduction made in the added load. In other words, it is assumed that the new bottom deposits effect on DO drop will be 17,850 ÷ 34,350 of the DO drop due to bottom deposits under normal load conditions. Therefore, 17,850 ÷ 34,350 × 5.59 = 2.90 ppm, which is the drop due to bottom deposits under 50 percent load conditions, 25°C, and 280 cfs at F. The total drop under reduced load is thus 2.47 plus 2.90, or 5.37 ppm. Since the bottom materials will not be reduced immediately upon reduction of the load at the source, it will be perhaps a year before the full effects of the load reduction will be evident in the stream.

If field observations in Main River above pollution show that DO concentrations during low flows and warm temperatures get as low as 7.0 ppm, (as they actually do at Station A) then with a drop of 5.37 ppm from here to the bottom of the sag, the DO at the sag will be only about 1.6 ppm. From this value it is obvious that 50 percent reduction in the added load at Industrial Plant is not enough for critical periods. By repeating the calculations for greater load reductions, the allowable load for any desired minimum DO at the sag can be readily determined.

The Multiple Correlation Method—The second method of computing the load at F for any load condition at the source, is the multiple correlation method. It is so named because it is possible to compute the load at F from the basic equation: BOD Load at F = f(Load at A + C, temperature, stream discharge) or BOD Load at $F = a + b_1$ (Load at A + C) $+b_2$ (Temp.) + b_3 (Discharge).

By again using observed data in a way similar to that used for determining the constants in the DO drop formula, the constants in the above equation can be evaluated. They are determined to be as indicated in:

BOD Load at F =
12.086 + 0.179 (Load at A+C)
−0.394 (Temp. at F)
+1.197 (Disc. at F) ..... (5)

In this equation loads are expressed in 1000 pounds per day, temperature in °C, and stream discharge in 100 cubic feet per second.

Testing this formula as before by using it to compute loads at F for the observed conditions, produces results as shown in Fig. 3. In the case illustrated, the erratic nature of the load at the source results in a number of observed loads at A + C being materially less than the load observed at F. (In the more usual pollution situation the load at the source will not fluctuate so rapidly with time.) However, in spite of this, a respectable coefficient of multiple correlation, R = 0.746, was obtained.

By using Equation (5) for any desired load at A + C, the corresponding load at Station F is readily computed. Until the load at A + C is actually reduced, there is no way to prove it but, theoretically at least, Equation (5) should give a more accurate prediction of the load at F than the method of proportions. This is so because the correlation procedure takes into account the effects of changes in temperature and discharge on the load at Station F as well as the effects of the load at Stations A + C. By applying the equation for 50 percent load reduction at Station C, computing the DO drop by Equation (3), and correcting for bottom deposits, a DO drop to the sag of 5.26 ppm results for conditions of 25°C and a flow of 280 cfs. This result is very close to the 5.37 ppm value obtained by the method of proportions. While for some other flow and temperature conditions the agreement is not this close, still the two procedures yield results that agree reasonably well.

Desirable Field Observations

Sampling Stations—While existing circumstances will govern in any particular situation, in general, four sampling stations are desirable. Station 1 should be located just upstream from the source of pollution under study. Station 2 should be located as close below the source of pollution (or sources, if more than one) as it is possible to obtain an accurate measurement by multiple-point sampling across the stream. When pollution is discharged from a sewer, or tributary stream, on one side of a relatively wide river, getting an accurate measurement of the load and the mean DO concentration is not a simple matter. What is desired, of course, is to obtain enough samples, properly spaced, so that the

composite BOD sample will represent the weighted mean BOD load of the cross section and an average of the individual DO observations will represent the weighted mean DO concentration.

In the past, many attempts have been made to measure the BOD load discharged to the stream by sampling and measuring the flow in individual sewers. Such samples are then usually set up with standard dilution water and, if the sewer carries industrial waste only, bacterial "seed." Naturally, such samples will show oxygen used upon incubation. However, any attempt to convert the BOD so measured to the BOD of the waste exerted in the stream is headed for failure. There are too many differences in the two conditions. In the stream, the concentration of waste, the bacterial nutrients, the various kinds of bacteria and protozoa present, the concentrations of any toxic materials, and other factors, may be so different from the artificial conditions set up by the BOD procedure followed in a "land" survey that the results of the two measurements may be far apart.

Station 3 should be near the location of the bottom of the DO sag as the sag occurs at lowest flow and highest temperature.

Since BOD values are progressively reduced as the distance below the source of pollution is increased, more sensitivity, and hence accuracy, will be obtained by thus locating Station 3. This is true since it is the BOD data from Station 3 that will normally be used in the DO drop formulation. In most situations, the investigator will know just about where this location is from prior observations but if not, a trial run or two will usually indicate the approximate location. Where considerable doubt exists as to the location of the bottom of the low flow sag, and sampling is to begin before low flows occur, if a choice between two bridges exists, the upstream location should in general be chosen. This may result in more sensitivity in BOD values and yet will permit close estimation of DO values at the bottom of the sag even though the low point is some distance downstream from this station.

Station 4 should be located about half way up on the recovery end of the oxygen sag. Naturally this "half way up" point will not always be in the same geographical location since the sag shifts its shape under varying loads, temperatures, and stream flows. However, as for Station 3, the exact location of the station is not critical.

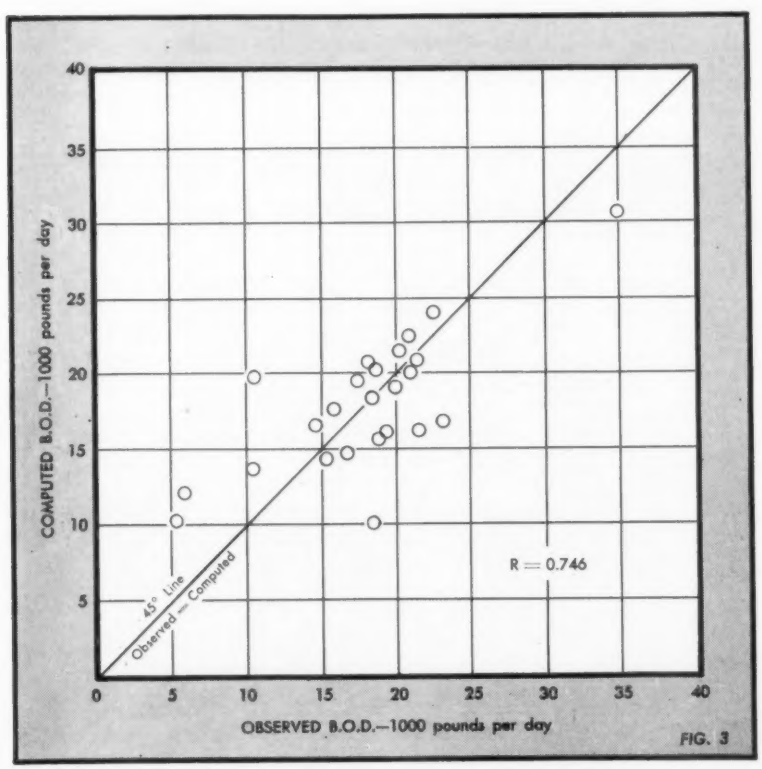


FIG. 3

● **CHART shows correlation of observed and computed B.O.D. loads at Station F.**

The guiding principle in station location is to so locate the stations that the low point of the DO sag can be accurately estimated by drawing in the DO profile between stations. These profiles obviously must be very carefully drawn. If it is possible to get a profile by boat, and thus get numerous points along the DO profile for one or two low-flow conditions, the shape of this detailed profile will help a lot in determining the shape of those profiles with less points available. It would be helpful, of course, to get such a detailed profile before the stations are selected. If bridges are not reasonably well located for the purposes of the study, boats should be used for the regular sampling. It is obviously impossible to get good results from the study if the basic field data are inadequate or faulty.

Obviously, the stations need not be limited to four in number, but in most cases four should be enough. In some cases more will be desirable. There are, no doubt, many river reaches for which suitable sampling data already exist from previous years that can be analyzed by this proposed method.

At each of the four stations, DO and temperature determinations should be made, and BOD samples collected. Stream discharges are naturally essential to the study. A stream gage in the reach under observation would be desirable, or in any case a gaging station should be near enough to enable close estimates to be made of flows on the sampling days.

An important over-all item to consider is the possibility of using BOD values from Station 2, instead of from Station 3, in the determination of the constants of the DO drop formula. In any situation where the load does not vary frequently and abruptly, it should be possible to use Station 2 BOD values. If this can be done, the relationship between DO drop to the sag and the load at the source of pollution will be determined directly by the DO drop formula. In this case the whole problem will be greatly simplified. Where suitable data now exist that can be analyzed by this proposed method of analysis, the first multiple correlation computed should be that using BOD data from the station just below pollution. Should this correlation turn out to be only fair, BOD data from a location such as Station 3 should next be tried.

In a situation where upstream pollution (or a storage impoundment)

(*Continued on page* 186)

Coordinating Subsurface Utility Installations

LESLIE B. ALLAN
Commissioner of Works and Roads,
Municipality of
Metropolitan Toronto, Canada

THE MUNICIPALITY of Metropolitan Toronto Act of 1953 provided for the federation of the Municipalities in the Toronto Metropolitan Area for certain financial and other purposes. By this Act the inhabitants of the following Municipalities were constituted a body corporate on April 15, 1953, under the name of "The Municipality of Metropolitan Toronto": City of Toronto; Township of East York; Township of Etobicoke; Village of Forest Hill; Town of Leaside; Village of Long Branch; Town of Mimico; Town of New Toronto; Township of North York; Township of Scarborough; Village of Swansea; Town of Weston; and Township of York.

The new Metropolitan Area embraces approximately 153,000 acres and has a population of more than 1,250,000. Before outlining the procedure adopted for co-ordinating the installation of public utilities within the Metropolitan Municipality, I should like to outline the manner in which public utility work in the City of Toronto proper, with its 22,000 acres, was carried out during the past quarter century.

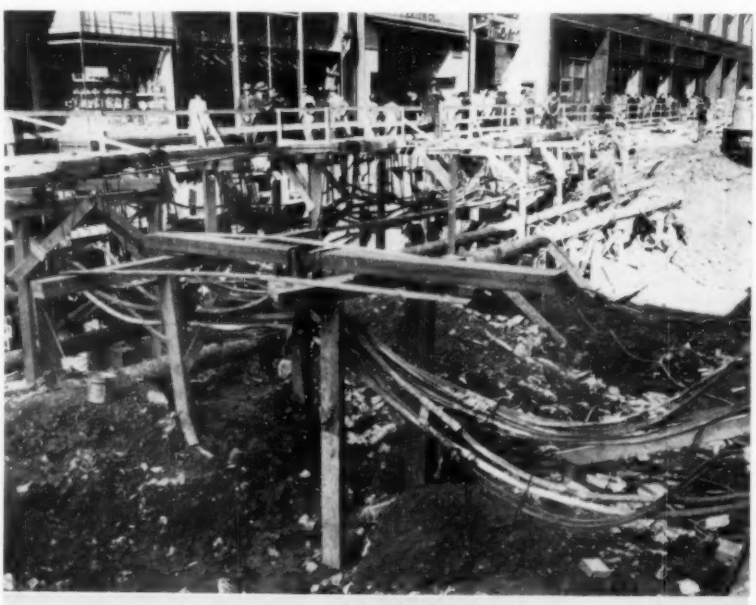
By the early 1930's, the problems presented by the underground services installed beneath the streets of the City had attained such dimensions that serious thought had to be given to the subject by municipal and utility officers. There was a time when the only service lines beneath the streets were gas mains, water mains and sewers; and, in the early days, these did not present any great complication. The first light and power, telegraph and telephone lines were carried above ground on poles but, as the City developed, demands for service increased, with the result that the multiple lines required could no longer be accommodated on overhead structures. The alternative, of course, was to go underground, along with several other public utilities.

Up to 1932, individual records of the public utilities and the Department of Works of the City of Toronto were kept on file in the offices of each utility concerned. The Department of Works recorded its own construction and also received applications for approval of installations of underground work by the utilities. These applications were approved or alternative suggestions offered until a line satisfactory to all parties was determined. Upon approval, the utility company was duly notified and the work undertaken. Necessary records were maintained and plans filed. This system, while complete as to records of individual installations, did not contribute to a composite picture of the complex conditions which were building up under the City streets.

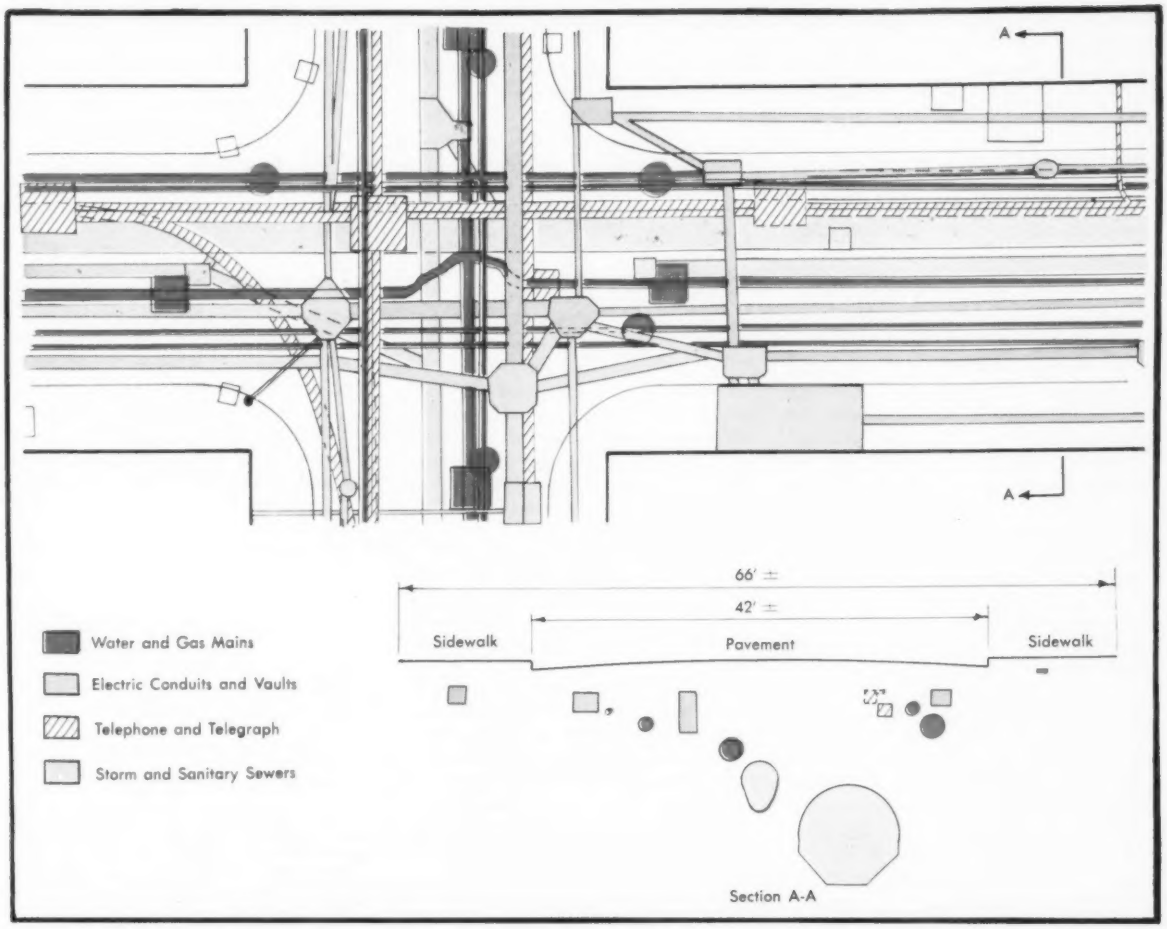
Having regard for the problem being confronted, and the economic waste involved by the haphazard methods and planning practiced, officials of the Department of Works of the City of Toronto and officers of the local public utility bodies formed a Public Utilities Co-ordinating Committee more than 20 years ago to plan and adopt standard methods of practice and design.

It is interesting to note that, at about the same time, the American Society of Civil Engineers appointed a "Committee on the Location of Underground Utilities". This Committee included City Engineers, City Planning Engineers, engineers with light and power experience and consulting engineers who specialized in municipal work. After five years spent in the collection and consideration of data, an exhaustive report on this subject was presented, dealing extensively with the various phases of the problem and offering carefully considered recommendations for the guidance of municipalities and utility companies. Many of the recommendations were similar in scope to the terms of reference adopted for the City of Toronto Public Utilities Co-ordinating Committee.

In its first year of operation, the new PUCC decided to meet at least once a month and scheduled special meetings to be called by the Chairman to deal with any emergency which might arise. The Committee



● **RECENT subway construction brought to light a complex network of sub-surface utilities. Coordinated plans greatly facilitated relocation of all wires and pipes.**



● **A PORTION of one of the plans of existing structures maintained by the Public Utility Co-ordinating Committee.**

consisted of representatives of the City and of the three large utility companies, the Consumers' Gas Company, The Bell Telephone Company and the Toronto Hydro Electric System. The Toronto Transportation Commission later became a member.

Actually, the Committee had no legal status, and any joint action could not in any way jeopardize charter rights or disturb legislative procedure.

Terms of reference for the Committee were quite comprehensive in nature, and the following were included in the scope of its work:

Locations for New Work

Had the early officials of Toronto, or any other city, been able to pierce the veil of the future and see the complexities that would develop beneath the streets, they probably would have taken steps at the outset to design and plan them carefully with respect to location and depth; in other words, an ideal plan would have been established.

Realizing that utility structures installed prior to its inception could not be adjusted or revised in accordance with an ideal plan, the new Committee immediately insured that all future work would be carried out on a planned basis. An ideal plan was adopted indicating for each utility company specific space and depth related to the street lines, and this plan was used for all future work except in the case where a previously existing utility conflicted. In this case, the Committee met to determine an alternative location, and the problem was resolved in an amicable manner.

Approval of New Projects

The practice was introduced and followed of discussing in Committee the engineering details for all projects of major importance, so that agreement might be reached with regard to the relation of each utility to the proposal. In cases, such as the construction of the Rapid Transit System in the City, which entailed alterations and re-location of numerous utility structures, the Committee saved much valuable time in the co-ordination of the work and considerable expense in regard to the re-location work. Other projects for which the Committee proved a valuable asset were construction of the natural gas main from the United States through the City, the burying of all telephone and hydro lines on main streets in the central portion of the City, and many others.

Adjustment of Differences

In any city the size of Toronto, where so many varied interests are closely associated, situations naturally arise which require considerable negotiation and compromise. The Committee has always served as a co-ordinating body for such matters, and in its twenty-two years of operation there have been no difficulties which have not been eventually settled in a satisfactory manner.

Co-operation: Co-operation between parties is one of the intangible factors which produce practical

results and permit successful completion of work. Since inception of the Committee, a spirit of co-operation between the members has always existed.

Composite Plan: The Committee maintains public utility plans of existing structures on all streets within the City. These plans are prepared on linen, using a scale of twenty feet to the inch and, on completion of the linen, whiteprints are forwarded to each utility company or member involved, for their files. Revisions to underground structures, if made, are recorded immediately thereafter on these plans. Four thousand of these utility plans will be required to cover all the streets in the City of Toronto; and, while these plans do not exist for every street in the city at the present time, a comprehensive program of plan preparation has been maintained for the past twenty-two years. If a street is scheduled for widening, transit construction or other work, then the public utility plan preparation for that street is given priority.

A print of a public utility plan on a reduced scale for one of the main intersections in the City of Toronto is shown in this article. A color is used by each utility when filing their records of utility plans. While the plan scale is twenty feet to the inch, cross sections are indicated on the plan and all sub-surface construction is indicated, including areaways, etc.

It may be of interest to note that survey work for utility plans is carried out by an independent crew, which records all existing manholes and structures evident on the surface of the street. These surveys are referred to a base line grid which has been established for the entire city.

In the foregoing, I have briefly outlined the functions of the Public Utilities Co-ordinating Committee, which was in existence in the City of Toronto at the time the Municipality of Metropolitan Toronto was formed. Having regard for the accomplishments achieved by the Utilities Committee in the City of Toronto since its inception, it was decided that a Co-ordinating Committee should be immediately established for the new Metropolitan area. This Committee—the Public Utilities Co-ordinating Committee of Metropolitan Toronto—was organized on January 21, 1954, under the Chairmanship of the author who is Metropolitan Commissioner of Works, and who had been Chairman of the Public Utilities Co-ordinating Committee of Toronto. Col. F. S. McPherson, Supervisor of Rights-of-way, The Bell Telephone Company of Canada, was appointed Secretary. This Committee is composed of the Chief Engineers of the thirteen Area Municipalities and their various Public Utilities Commissions, together with the Chief Engineers of The Bell Telephone Company, The Consumer's Gas Company, The Toronto Hydro-Electric System, The Toronto Transit Commission, and The Hydro-Electric Power Commission of Ontario.

In the twelve months since its formation, the new Committee has adopted an ideal plan for utility work, which will be carried out in the coming years on many of the roads in the undeveloped portion of the Metropolitan area. A start has been made on the preparation of utility plans for the rapidly developing fringe area around the City of Toronto proper. In addition, numerous meetings have been held in connection with the many major projects which are being carried out throughout the Metropolitan area. In this connection, Metropolitan Toronto, with its 153,000 acres, at present has a population of 1,250,000, and a priority list for capital works to the extent of $750,000,000 has been established. A great number of these projects are already under way, including expressways, street widenings, large trunk sewers, sewage plants, water mains, water plants, and other related works.

In the Metropolitan area, with population increasing to the extent of 50,000 a year, and with the associated extension and enlargement of utility services into the rural sections, the utility services are being planned on a co-ordinated basis, and little difficulty is being experienced.

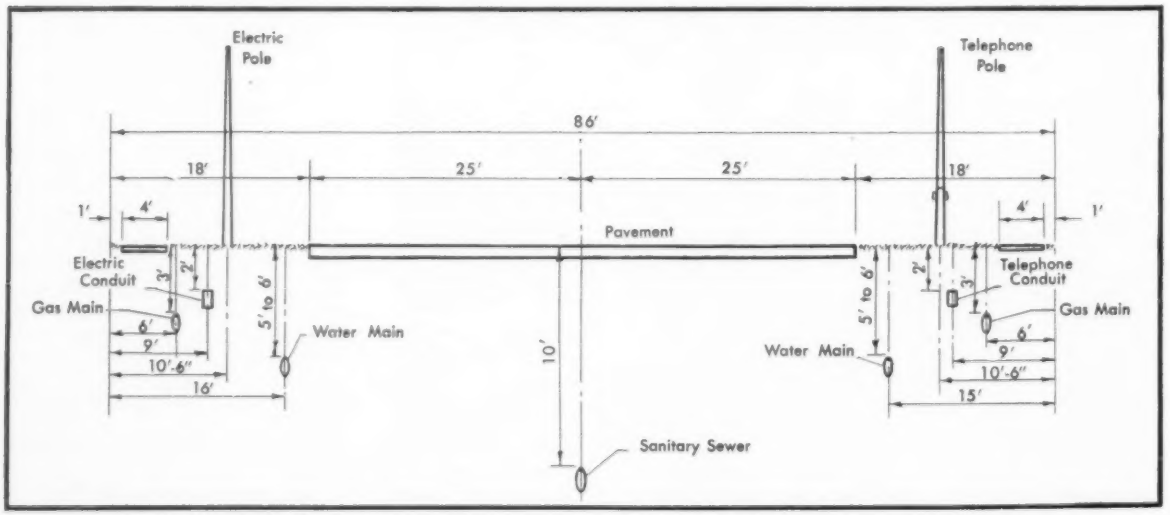
Existing Utility Services

It may be of interest to give some description of the public utility services in the Toronto Metropolitan area.

Gas Mains: The Consumers' Gas Company of Toronto was incorporated on March 23, 1848. Since then, the demand for gas has grown progressively to the point that the Company has 2,000 miles of mains and service pipes in the Toronto Metropolitan area. With the recent construction of a pipe line from the natural gas areas in the United States to the City, it is expected that demands for service will be intensified in the future.

Water Mains: As the population of

(*Continued on page* 184)



● **IDEAL SECTION proposed by the Metropolitan Toronto Public Utilities Co-ordinating Committee for an 86-ft. right-of-way.**

COUNTY ROAD IDENTIFICATION

and Numbering of Rural Residences

A. K. BRANHAM,
Research Associate,
Joint Highway Research Project,
Purdue University

JOE WAS servicing a customer's car when young Doc Cutter braked his car to a screeching halt on the driveway. "Joe, I have an emergency at Guffey's gravel pit. I understand it's near Glacier Gulch. Can you help me?" "Sure, Doc," Joe pointed and said, "Take this highway south about seven miles, and then, instead of bearing left with the paved road at Flock's Poultry Farm, continue straight ahead on the County Farm Gravel Road. The road winds a bit, but after about two miles you'll come to a five-point intersection. Take the road that cuts sharply to the right, follow it to the third cross-road, then turn left. It's only about a mile from that intersection to Glacier Gulch. Stop at Emil's black-smith shop in Glacier Gulch and he can tell you how to get to the pit."

Then Joe remembered something a customer had said earlier that morning.

"Wait a minute, Doc. That bridge over the Gulch washed out last night. You'll have to detour after you reach Five Points. Go straight ahead to the first cross-road, turn right and after several jogs you'll hit a T-road. Turn right and go about 80 rods and you'll see Glacier Gulch down in the valley. You can't miss it!"

You can't blame Joe because Doc promptly got lost. He was only trying to help. He wasn't responsible for laying out the county road system.

These weird directions are typical of the hundreds which Joe and others each day offer the public. They strongly suggest the need for an orderly and systematic method of local-rural-road identification and dwelling unit number to relieve delays and confusion and to provide for economic service.

The rapid development of motor vehicle transportation and the desire for more effective rural development and better community services at the county level have increased the need for an orderly method of identifying local roads and dwelling units in rural areas. Among the community services to benefit from such a procedure are the public utilities, fire protection, medical and veterinary aid, all types of delivery routes, and other activities of similar character. In addition, improvements in accounting and cost control procedures, and in highway planning are important benefits to be received by the counties through better identification of the components of the highway system.

A county road system that will provide for better community services and the general improvement of an area requires proper identification of local roads and rural dwelling units and an effective system for accounting and cost control. The latter is an important factor in the determination of highway users' responsibility and for highway planning.

Recent Indiana Legislation

The development of a rural identification system was given impetus by two laws passed by the General Assembly of Indiana in 1953. One Act, No. 115, authorized the counties to prepare charts, signs and maps designating thereon either a name or a number for all county roads. The second Act, No. 230, pertained to the employment of clerical assistants by county highway departments and prescribed a system of records to be kept by the counties.

Section 1 of Act No. 115 states that the county planning commission of any county, or the board of commissioners, may authorize the preparation of charts or maps and they also may authorize the purchase and the installation of signs showing the number or name of said County road. The counties with a population of 400,000 or more shall provide for the numbering of residences on such roads. In section 2 the county planning commission, or board of county commissioners, shall utilize the services of the county engineer and/or county surveyor who shall prepare such charts or maps. Section 3 says that such charts or maps shall be available to all units of government free of charge and to the general public at a charge to be determined by the county planning commission or board of county commissioners. Section 4 states that, whereas an emergency exists for the immediate taking effect of this act, the same shall be in full force and effect from and after its passage.

It will be noted that several shortcomings of this law should be avoided. The law permits the making of charts and maps and the marking of roads, but it is not mandatory and there is no provision for uniformity, nor authority for uniformity, in the development of county road-marking systems. There are no specifications for the marking of roads in terms of accepted practice and there is no provision for the numbering of rural dwelling units in counties with populations of less than 400,000 persons. There is no specific statement concerning the source of funds available for the purchase of road markers and there is no provision for the maintenance of rural road markers.

Section 1 of Act No. 230 states that the board of county commissioners of any county shall be required to employ a clerical assistant or assistants for the county highway department of such county, who are competent to keep accurate books and records of such depart-

ments as required by the state board of accounts. Section 2 designates that the state board of accounts shall prescribe a system of records that will adequately reflect the following: The total outstanding liabilities of the department at all times; the cost and maintenance of the department; the cost of material and equipment used by the department; and an accurate inventory of all equipment status, materials and supplies. Section 3 states whereas an emergency exists for the more immediate taking effect of this act, the same shall be in full force and effect from and after its passage.

The procedures described herein, which were based on these acts, were submitted and subsequently adopted, in general, by the Indiana Association of County Commissioners.

Uniform Identification System

A uniform system of identification and control is desirable. Each county should serve as a basic unit, but identification methods should be uniform for all counties in the state. If the specifications and methods are uniform, the residents in one county may easily interpret the county road marking and dwelling unit numbering in other counties.

The establishment, use and evaluation of accounting and cost control procedures that are uniform throughout the state, should facilitate the work of the county officials and others who are responsible for planning and programming an effective system of rural roads. They should also facilitate evaluation and control at the state level. Such procedures should show the quantity and quality of the expenditure.

The identification and location of county roads relative to established base lines in each of the counties of Indiana, or in any state, may be accomplished in a manner similar to that used for state highways, but certain basic characteristics of the local-road problem must be considered in the development of the procedure. In general, the character of travel on the local-roads is predominately intra-county, and includes some inter-county and interstate movement. Most of this local-road travel is to-and-from the county seat, or other trade areas in the county, and in adjacent counties. The patch-work of short-section and variable-direction local-roads does not always lend itself to the development of continuous routes within a county or between counties.

Thus, it is desirable that the methods used for identification and relative location of roads, and in the numbering of rural dwelling units, should be closely associated with the character of the travel on these roads, be county-wide and uniform throughout the state, provide for continuity with adjacent counties, when possible, and employ engineering survey techniques.

Land Survey Principles

Lands within a state or county are loosely described as being within certain political boundaries, but they are surveyed and recorded on an engineering basis. The political township does not necessarily coincide with the engineering survey township. Range and township lines are to be preferred over political boundaries as they have reasonable uniformity throughout the state. A grid system, or rectangular coordinate system, drawn along township and range lines near the center of each county presents the best approach to a problem that has a scientific background rather than a political background. Thus, it appears that boundaries established by engineering methods are preferred over boundaries established by political methods, and methods of identifying rural roads and dwelling units should follow this procedure.

Fundamental guides in the development of a uniform system of rural road marking and dwelling unit numbering are found in the principles of the U. S. Land Survey. The State-Wide Highway Planning Surveys conducted in Indiana and other states in the late 1930's, used these basic principles in the development of the General Highway and Transportation Maps of the counties. In this study, similar principles were used to establish the base lines needed in the development of the method for rural road and home identification.

In applying these principles to

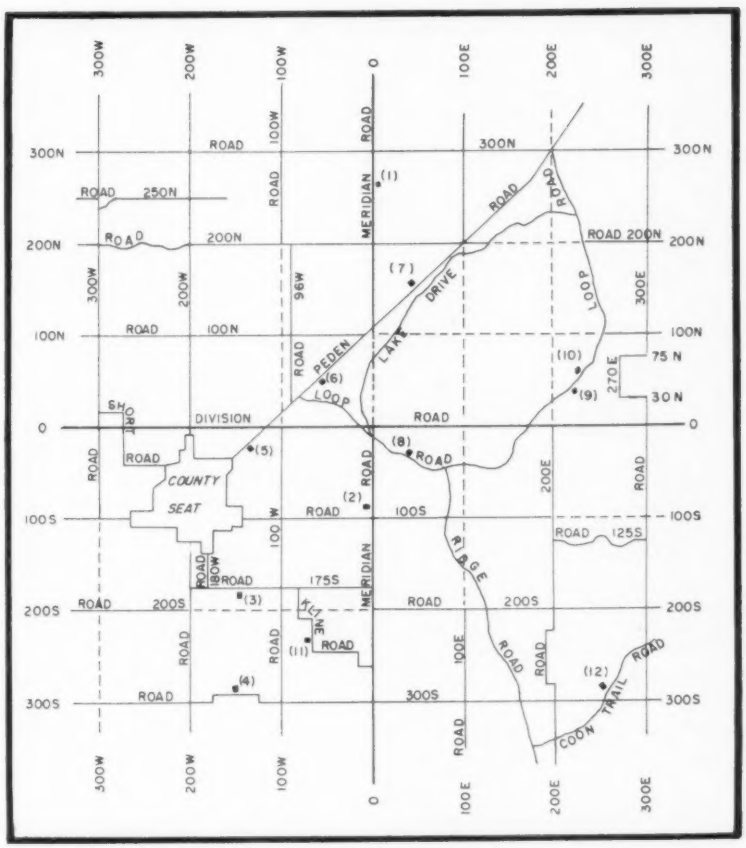
● **FIG. 1. Recommended basic lines for rural markings, with examples of continuity.**

naming and numbering of roads in Indiana, each county is divided into four quadrants, as illustrated in Fig. 1, Recommended Base Lines for Rural Road Marking. The base lines of the quadrant coincide with a projection of the Range and Township line intersection near the center of each county.

Fig. 1 illustrates how the intersections of Range and Township lines near the center of each county in Indiana coincide with section lines; and when extended to each county boundary, they form the base-lines of the North-East, North-West, South-East, and South-West Quadrants of the county. Many of the intersecting range and township lines are relatively close to the county seats, and when feasible, coincide with the base lines of adjacent counties to provide for continuity.

This continuity is also illustrated in Fig. 1 where the Second Principle Meridian forms the range (North-South) base lines in Clinton, Boone, Hendricks, Morgan, Monroe, Lawrence, Orange, and Crawford counties. It also shows continuity of township (East-West) base lines in LaPorte, St. Joseph, Elkhart, LaGrange, and Steuben counties. Additional examples of continuity may be observed.

If roads are located along all or part of the east-west and north-south base lines, they are designated as Division Road and Meridian Road, respectively.



● **FIG. 2. EXAMPLES of road and house designations are shown above. (1) would be designated 263N Meridian Road; (2) is 88S Meridian Road; (3) 144W Road 175S; and (4) is 151W Road 300S. On diagonals (5) is 21S 134W Peden Road; (6) would be 52N 56W Peden Road; and (7) is 151N 43E Peden Road. Addresses on irregular roads include (8) which is 28S 39E Loop Road; (9) 39N 222E Loop Road; (10) 51N 230E Loop Road; (11) 238S 69W Kline Road; and (12) 285S 252E Coon Trail Road.**

Roads Numbered by Distance

Section line roads and others paralleling these base lines form a rectangular coordinate system with Division Road and Meridian Road serving as base lines, as illustrated in Fig. 2, Examples of Road and House Designations. The numbers assigned to these section line roads and other parallel roads represent the progressive distance of each road from the base lines.

The first section line parallel to a base line is designated by the number 100 (it could be 1000 if greater accuracy is needed), followed by the letter of direction (N, S, E, or W) from the base line. Thus, the first section east of the north-south line, Meridian Road, is designated as 100 E, and a road along that section line is designated as Road 100 E. Similarly, a section line road 3 miles south of the east-west base line, Division Road, is designated as Road 300 S.

Roads parallel to the base line roads, but located between section lines, are assigned their relative position and number by dividing each section (about one mile) into one-hundredths of a mile. Progressive numbers are assigned to show the position relative to sections and approximate distance from the base lines. Thus, a road along a quarter-section line that is about 1¾ miles south of the east-west base line, Division Road, would be designated as Road 175 S as shown in Figure 2.

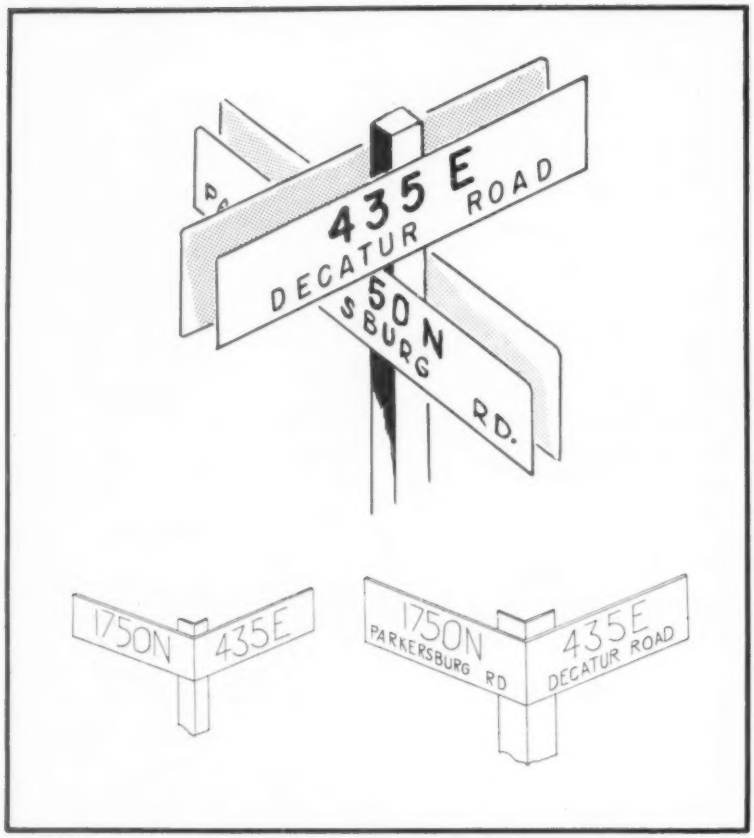
The numbers assigned to intersecting roads on this grid system clearly show the approximate distance and their position relative to parallel section roads and base roads. Fig. 3, Typical County Road Identification Signs, illustrates the legend on road signs at an intersection that is 17 and 50/100 miles north and 4 and 35/100 miles east of the intersecting base line. It also shows single and double face signs, two methods for the identification of roads, and two positions for mounting the signs.

Local road names may be used, but all maps, road signs, and directories should use rectangular grid designations. It is obvious that if road names were eliminated, the cost of road signs and printing would be appreciably lower. (Double face signs as shown in the upper part of Fig. 3 are preferred.) In any case, the sign should conform with the approved practices for installing signs.

Special "Problem" Roads

Diagonal, curving, and jogging roads present a problem because they change direction, and, thus it is difficult to assign a distance number or direction letter to all segments of the road. The following general principles should be used when applicable:

1. Roads with irregularities of less than one-tenth of a mile from the normal east-west or north-south location should carry the same numerical designation



● FIG. 3. TYPICAL county road identification signs. Style at top is preferred.

throughout, as illustrated by Roads 300 S, 200 N, and 125 S in Fig. 2.

2. If an individual straight-line jog in an east-west or north-south road exceeds one-tenth of a mile, it should be considered as a separate road and assigned a number, as illustrated by Road 96 W, and by jogs 30 N, 75 N, and 270 E in Fig. 2.
3. Loop roads formed by slight deviations due to topographical barriers should be considered as straight roads, as illustrated by the loop formed near the intersection of Road 250 N with Road 300 W in Fig. 2.
4. Roads with irregularities, except for a single straight-line jog, exceeding one-tenth of a mile from the normal east-west or north-south location should be named, as illustrated by Peden Road, Loop Road, and Kline Road in Fig. 2. Consideration should be given to naming these roads on a systematic manner, including a direction letter in keeping with the general direction of the road.

Where an east-west, north-south, or variable direction road coincides with a road in the State Highway system, the legend of the intersection sign should also include the number of the State Highway route.

Each county should number (and name when necessary) all roads within the county and the county line roads and houses on its south and west boundaries. The counties of Indiana which are adjacent to Illinois, Michigan, and Ohio should assign the name State Line Road to boundary roads.

System for House Numbers

House numbering may be accomplished through application of the basic grid system used in road identification. Thus, the house numbering system gives the relative position of the rural residences to about the nearest one-hundredth of a mile from the section lines.

It is proposed that the last two digits of a house number refer to hundredths of a mile in a section and that digits to the left represent section lines to the nearest whole mile. For example, the legend 1225 E means that the house is about 12 and 25/100 miles east of the base line. In this example the direction letter designation in the house number, when combined with the direction letter designation in the road number, indicates the quadrant of the county in which the house is located. Thus, the number 1225 E road 100 S means that the house is in the southeast quadrant of the county.

Houses along east-west or north-south roads could easily be assigned true coordinate positions, but they could be more easily found if numbered as follows: 1. Odd-hundredths (29, 201, 325) are assigned to houses on the North or East side of a road. 2. Even hundredths (30, 202, 324) are assigned to houses on the South or West side of a road.

Examples 1-4 of Fig. 2 illustrate the method of numbering houses on roads classified as east-west or north-south roads.

House numbers on diagonal, curving, and jogging roads follow the distance and position concept used in the location and numbering of roads, as illustrated in Fig. 2. The rectangular coordinate system is applied with equal facility to roads of variable direction. The application of this system calibrated to the mile, tenth of a mile, and one-hundredth of a mile gives the distance and direction of a house relative to the base lines. Where greater accuracy is desired, calibration to one-thousandth of a mile may be necessary.

Example 5 of Fig. 2 illustrates how a house at that position on Peden Road is assigned the number 21S 134W Peden Road. The 21S indicates that the dwelling unit is about 21/100 miles south of Division Road, and the 134W indicates that it is about 1 and 34/100 miles west of Meridian Road. Examples 6 to 12 also illustrate how houses on variable direction roads are assigned numbers by this method.

The assignment of odd or even numbers, as prescribed for numbering houses on east-west or north-south roads, is not practical for diagonal or meandering roads. The true coordinates, however, give the position relative to the base lines and permit easy location.

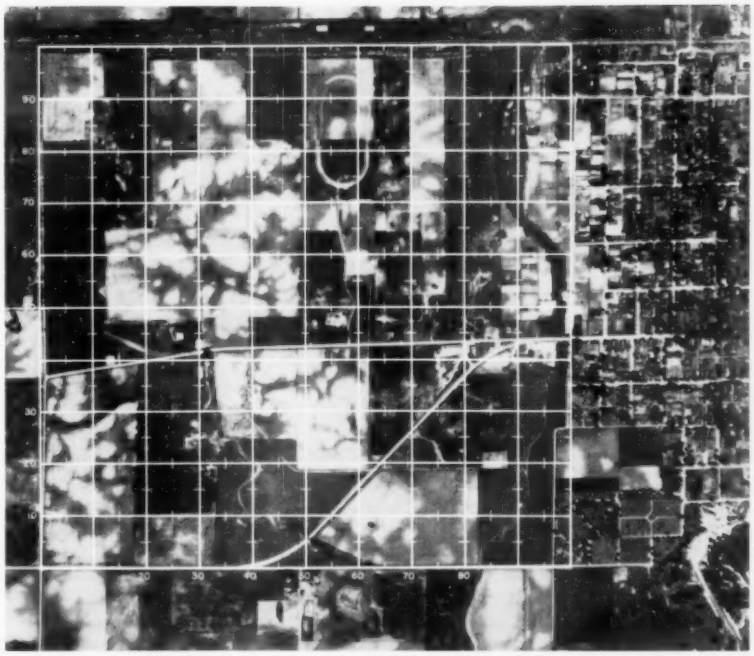
Where a road of the State Highway system coincides with a road classified as an east-west or north-south road, or as a variable direction road, it may be desirable to include the State Route number as a part of the rural address.

Airphotos Aid Location

House numbering by the rectangular coordinate method becomes a relatively easy procedure where air-

photos at the scale 3 inches equal one mile, or some other appropriate scale, are available for each county. Fig. 4, Rectangular Grid Overlay on Air Photo Pattern, shows how a transparent grid overlay of the same scale coincides with the section lines of the airphoto and gives an accurate coordinate location for each dwelling unit and road. It must be recognized that the distortion of the photograph plus the expansion or contraction of the photographic material used for the registration of a scale 3 inches to one mile, may vary the scale from about 2.7 inches to 3.4 inches to one mile. Thus, several transparent overlays with scales of 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, and 3.4 inches per mile may be necessary. Assignment of numbers to dwellings and roads shown on the airphotos involves an accurate measurement of the distance between section lines or section line roads and the selection of the appropriate overlay to give the proper position of each dwelling unit. If only one grid is available, that is, 3 inches to one mile, a correction factor could be used after accurate measurement of the section distance had been made. Using this method, one who is familiar with airphoto interpretation may locate rural dwelling units accurately and rapidly.

The use of recent airphotos of proper scale would give an accurate presentation of all roads, houses, bridges, and other cultural information without laborious and costly field work. It would also provide a means of providing current information needed for planning, taxation, and other activities.



● **FIG. 4. EXAMPLE of a rectangular grid overlay on an air photo pattern.**

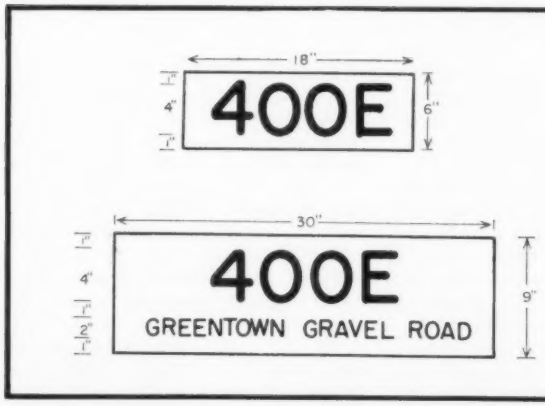
Standards for Road Signs

Road signs should conform with standards suggested in the "Manual of Uniform Traffic Control Devices for Streets and Highways." The following minimum standards are suggested to provide for economy of design and for uniformity, legibility, and visibility of the signs:

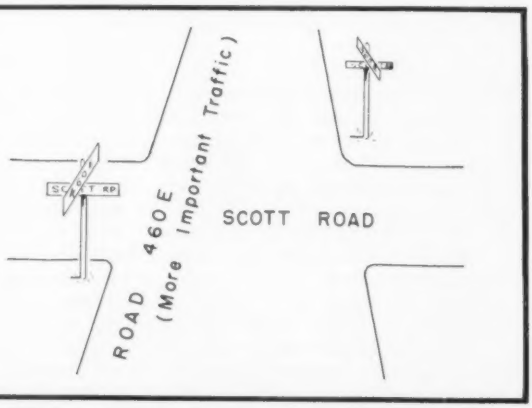
Color and Visibility of Sign—Black letters or numbers on a white background are recommended. The signs should be reflectorized, and at critical intersections they should also be illuminated.

Legend—The letters or numerals of the primary legend (Road number or name, as illustrated in Fig. 5, Minimum and Maximum Sizes of Local, Rural, Road Signs) should be at least 4 inches high, while those of the secondary legend (supplementary name) should be at least 2 inches high. The size, shape, and spacing of the letters and numerals should conform to the standards available from the Bureau of Public Roads.

Sign Plate Specifications. A horizontal rectangle, with a minimum height of 6 inches, is required for signs limited to a primary legend. The height must be 9 inches when a secondary legend is used. The length may vary from 18 inches to 30 inches, depending upon the legend. Sheet iron or steel signs should be 18-gauge or heavier, depending upon size and rigidity desired; aluminum sheet and other materials should have sufficient rigidity. All should be able to withstand a 100 mph wind. Double-faced signs should be used.



● **FIG. 5. Minimum and maximum sizes of signs for local rural roads. These should conform with uniform standards.**



● **FIG 6. Road identification sign locations at intersections where average daily traffic exceeds 250 vehicles.**

Mounting Height. Roadside conditions will, in general, have a significant effect upon the mounting height of the signs. The signs should be mounted on a fixed metal post. In rural areas the lower edge of the signs should be not less than 5 feet above the maintained edge of the road surface; in suburban or other areas under the jurisdiction of the counties, where obstructions may be caused by parking, a minimum elevation of 7 feet above the road or curb is required.

Sign Location. For intersections with average daily traffic volumes in excess of 250 vehicles per day, signs should be placed on diagonally opposite corners so that they will be on the far right hand side of the intersection for traffic on the more important road. (See Fig. 6). Double-faced signs indicating both roads should be erected at each location. In general, they should be placed not less than six feet nor more than 10 feet from the maintained edge of the road, and should be placed as close to the corner as practicable, facing traffic on the cross road.

At intersections with less than 250 vehicles per day, signs indicating both roads should be placed on the corner with best visibility.

A priority of erecting signs should be adopted by the county. It should be based upon those factors normally included in sufficiency rating and road classification procedures. Roads which perform the greatest community service should be marked prior to those of lesser importance.

Financing Road Marking

The cost of adequate signs and road markings of all types, and of their proper maintenance, is estimated to be about one or two percent of the annual county budget for highways. The necessary financing may be accomplished by county appropriation of funds, service club project, commercial development, or other methods. Several counties in Indiana have used county funds; others have used club projects in conjunction with commercial enterprises, generally in the form of directories of rural residents.

Maps indicating county road markings and house numbers should be prepared in accordance with established principles. It is reasonable to assume that directories of rural residents serve a useful purpose and that the sale of maps and directories could aid in financing the project.

All records of operation, construction, and maintenance of county roads should be in accordance with the principles of road marking and house numbering. Accounting and cost control records that are easily applied to the county road or parts thereof are essential to adequate road planning and programming.

The proposed system was adopted after presentation at several district meetings of the Indiana Association of County Commissioners during 1953. By late 1955 about half of the counties reported an active interest of road marking. Some have adopted the system in principle; others have installed signs on their county roads.

The adoption and installation of a uniform rural road and house identification system will greatly facilitate the use of these roads for fire protection, law enforcement, medical and veterinary aid, delivery service, and the general development of rural communities. In addition, if the system is supplemented by proper accounting and control procedures, the highway tax dollar will be spent in a more effective manner.

NEW RECORD SYSTEM GIVES TRUE WATER WORKS INVENTORY PICTURE

MARVIN C. SIMON, Head Clerk, City Distribution Division, San Francisco Water Department

WORKING OUT OF the San Francisco Water Department's central supply yard, our group is responsible for installation, maintenance and repair of all facilities within the city limits. This includes installation and service for some 125,000 meters, as well as construction and repairs for the network of mains needed to service them.

Cost control in the maintenance of a metropolitan water system is especially difficult because the operation allows no margin at all for error.

In the job of keeping a city's water supply flowing, any part or item which might conceivably be needed to repair a damage or breakdown just has to be on hand in our supply yard. There is no hedging or compromising on this point.

This requirement, however, is not an invitation to lay in large stocks of supplies according to whim or will. For a municipally-owned utility especially, there is constant pressure for sound management—including keeping at a reasonable minimum the capital tied up in inventories.

The fact that maintenance inventories can be tightened without sacrificing service is illustrated by a recent changeover in our stock control system at the San Francisco Water Department. We, of course, had been keeping perpetual inventory records for a number of years. But this older system, set up in the belief that we were doing the job most economically, eventually turned out to be little better than no control at all. This initial effort, however, did teach us three important lessons about effective stock control which were incorporated in our present system.

1) In the keeping of stock records, as with the material itself, it is necessary to fix responsibility. With our old system, no one person was charged with keeping up the stock

● **SYSTEM described in this article and pictured here has brought a new dependability to the $250,000, 4,000-item inventory of the San Francisco Water Department.**

● **IN ORGANIZING this new inventory system, enough outdated materials were discovered, which could be sold for salvage, to more than cover cost of the equipment.**

records. Whichever staff member authorized withdrawal of stock was supposed to make a corresponding entry on the inventory card. In the rush of other things, inventory accounts were frequently allowed to slide. Having failed to pinpoint responsibility, we had no assured way of enforcing accuracy.

Under our new system, then, we gave inventory record keeping, still only a part-time job, as a definite assignment to one person. Only he makes entries into these records, and he must stand for their accuracy.

2) To qualify as an effective management tool, a stock record must accumulate data on purchasing and usage experience and make it available for instant reference. With our former record system, the loose (and often misfiled) cards and the lack of fixed responsibility failed to establish this information.

What we need is a record which will give us an idea of the cost of each item, the length of time we have to allow for delivery, and accurate information on our usage experience. In the Remington Rand Kardex system under which we now keep our inventory records, the upper portion of each control pocket is devoted to a form which catalogues this information in orderly, easily usable form.

3) The equipment in which a stock record is housed should provide for maximum reference speed and offer protection against misfiling or loss of records. Loosely filed cards, our old method proved, cannot provide a tightly functioning control. With our new system, in which records controlling all 4,000 items which make up our inventory are housed in a Robot-Kardex unit, the control cards are assigned permanent, accurate-sequenced positions in visible pockets.

Designation of materials or items by description and catalogue number is handled with inserts in the overlapping visible margins at the bottom of the Kardex pockets. Since posting to the inventory records is done right in the Kardex pockets, the system combines the advantages of rapid reference and the elimination of the possibility of misfiling.

Working speed and operator convenience are also assured through the Robot-Kardex unit's mechanized operation. To get any given record, the operator merely presses a button corresponding with the Kardex tray he wants. The machine automatically delivers the tray to the desk in front of him in a matter of seconds. There are no drawers to pull and no file cabinets to search.

The setting up of the new record offered a potential operating problem because: 1) We did not have experienced personnel in our own department to assign to the organizing of the new system; and 2) We could not break our old routine for stores issuing and inventory control until we had something which was ready to replace it.

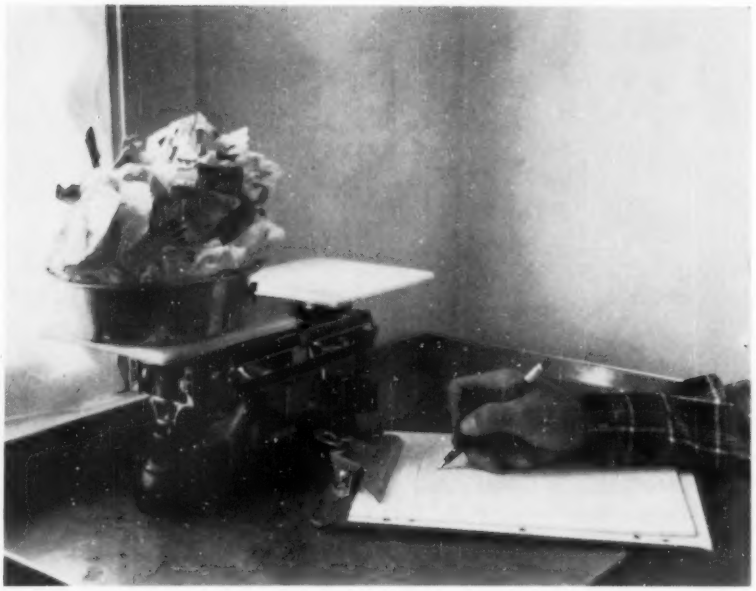
This situation was met simply and efficiently by arranging for Remington Rand's Business Services Department to assign their staff experts to set up the system for us. Without disturbing our people at all, the installation specialist organized the new file and incorporated current working information. The day we assigned our own clerk to the work we were in business on a going basis—with no transition period at all to bog things down.

As our new system works out, stores requisitions are cleared through the Kardex records as part of the routine of withdrawing materials from the yard. As the clerk charges out materials on a ruled form which fits into the bottom half of the Kardex pocket, he notes the new current inventory and compares it with figures entered on the same set of records to establish maximum and minimum balances for the item. When a current withdrawal brings stocks below the specified minimum, he prepares a purchase requisition which includes usage information for the guidance of purchasing officers.

From a management viewpoint, the Kardex records have given us new confidence through the knowledge that we can glance at a record—available in a matter of seconds—and know that it represents a true operating picture. At this writing, the Kardex records are still too new with us to establish their overall benefits. They have already proven, however, that they will enable us to secure more protection in the way of workable stores at a lower capital investment. With approximately a quarter of a million dollars now tied up in supplies, there is no question that we will experience substantial financial and operating gains.

As far as the investment in the Kardex system is concerned this was actually amortized by the time the new records were put in use. Just in organizing and setting up these records, we discovered enough outdated and unusable materials in the yards so that the salvage prices they brought more than paid for the new system. This, we feel, forecasts even greater benefits and smoother operations in the years to come.

GEORGE F. MALLISON
Phoenix (Arizona) Field Station
Communicable Disease Center
U. S. Public Health Service
and
WILLIAM F. HOHLOCH
Genesee County Health Department
Flint, Michigan



THE COMPOSITION OF RESIDENTIAL GARBAGE

THE COMPOSITION of East Lansing, Michigan, residential garbage was studied throughout 1954 as a supplement to investigations on high-rate composting of garbage and other organic wastes conducted by the Department of Civil and Sanitary Engineering, Michigan State University[1]. The study was planned specifically to determine the physical composition and the seasonal variations of the residential garbage (composition and quantity of municipal *refuse* are being studied separately[2]) that was used in pilot-plant composting studies. In addition, the investigation was designed to produce information to permit formulating a suitable synthetic garbage for laboratory-scale composting experiments. Also, the study was planned to contribute to the general knowledge on present-day residential garbage composition in other municipalities in the United States.

East Lansing, Michigan is a middle-income residential community with a population of 20,325 according to the 1950 census. During 1954, East Lansing's residential garbage was collected by the city twice weekly in paper wrapped packages. Rubbish, including most of the waste paper, was collected separately. Cans or bottles were seldom found in the residential garbage.

Samples were taken 2 to 4 days each month by selecting at random a total of 10 to 20 individual packages of garbage immediately after dumping at the composting plant. The complete contents of all of these garbage packages were sorted at once into nine constituent groups

Table 1—Composition of Residential Garbage on a Wet Weight Percentage Basis East Lansing, Michigan

Month (1954)	CONSTITUENT (see Note 1) A	B	C	D	E	F	G	H	I
January	17.2	5.5	14.8	8.9	12.7	0.8	13.6	19.4	7.1
February	16.7	4.4	19.9	12.5	14.2	3.9	7.8	12.8	7.8
March	21.1	9.4	17.5	5.3	7.1	11.0	4.9	14.1	9.6
April	18.1	7.7	23.5	1.7	13.8	2.9	12.4	10.4	9.5
May	15.4	10.3	10.1	9.8	11.9	3.2	15.2	14.3	9.8
June	23.4	10.1	9.4	5.6	29.8	2.6	6.1	5.0	8.0
July	17.5	8.2	0.8	2.3	46.3	2.9	7.7	5.5	8.8
August	15.4	4.1	2.9	8.0	25.2	4.2	5.8	12.1	22.4
September	25.0	5.4	3.0	7.2	39.2	1.8	5.0	6.7	6.7
October	26.7	16.7	4.7	5.7	18.0	2.8	8.3	10.6	6.5
November	24.2	13.8	8.1	6.5	7.8	3.1	12.4	11.0	13.1
December	21.1	8.6	21.8	5.3	13.8	7.3	0.0	12.8	9.3

Note 1—The following constituents were recorded: A—paper; B—meat, fat, fish and dairy products; C—citrus fruit; D—fruit not citrus; E—green and other salad vegetables and melons; F—coffee grounds and tea leaves; G—bread, pastry, sugar and cereals; H—corn, baked beans, potatoes and other root vegetables; I—miscellaneous.

Table 2—Average Percent Moisture Content and Composition of Residential Garbage, East Lansing, Michigan, 1954

Constituent	Moisture Content	Wet-Basis Composition	Dry-Basis Composition
Paper	31.0	19.8	33.2
Meat, fat, fish and dairy products	24.4	8.3	15.2
Citrus fruit	83.8	11.3	4.4
Fruit not citrus	85.6	6.8	2.4
Green and salad vegetables and melons	92.8	20.2	3.5
Coffee grounds and tea leaves	63.8	3.9	3.4
Bread, pastry, sugar and cereals	33.6	8.5	13.7
Corn, beans, potatoes, etc.	81.2	11.4	5.2
Miscellaneous	20.0 (Est.)	9.8	19.0

and weighed. The percentage composition by weight of each group was computed on a monthly basis. The total weight of garbage sorted per month varied from 16.3 to 41.6 pounds. The results shown in Table 1 are based on examining 183 packages having a total weight of 358 pounds.

Data on the moisture content of each constituent group, based on weights before and after drying at least 2 replicates per group (except for "Miscellaneous"), are given in Table 2. This table also contains the yearly average composition on a wet and dry basis and a detailed tabulation of the items included in each constituent group.

Discussion

The monthly garbage composition data (Table 1) indicate that most citrus fruit waste was disposed of during the winter and early spring. Also, the highest percentage of green and salad vegetable and melon waste and the lowest percentage of starchy food waste was thrown away during the summer months. These observations correlate well with general knowledge on seasonal variations in consumption of the foods from which these wastes were derived. With the exception of these variations, most of the monthly differences in the data may be explained as being due to the restricted sample size that could be processed.

The yearly average data on the composition of East Lansing garbage (Table 2) is comparable to that collected in a similar study in 1940 on New York City refuse[3], except that considerably more meat, fat, and fish and much less citrus was found in East Lansing garbage than in New York City food refuse.

The moisture contents of the fruit and vegetable waste found in East Lansing garbage were generally lower than those which would be expected in fresh edible portions of these foods[4]. This may be explained as being due partly to evaporation and partly to absorption of excess moisture from the fruits and vegetables into the paper used for wrapping the garbage packages.

A suitable synthetic garbage for laboratory purposes may be produced by combining a few of the most representative materials in each constituent group in table 2 in the proportions shown. This material would have a calculated moisture content of 60 percent, a value that is in agreement with the average moisture content actually found in large quantities of East Lansing residential garbage during composting investigations.

Table 3—Estimated Average Percent Composition of Unwrapped Residential Garbage

(Calculated on Wet Basis)

Meat, fat, fish and dairy products	10
Citrus fruit	15
Fruit not citrus	10
Green and salad vegetables and melons	25
Coffee grounds and tea leaves	5
Bread, pastry, sugar and cereals	10
Corn, beans, potatoes, etc.	15
Miscellaneous	10

An estimated average composition of unwrapped residential garbage in other municipalities in the United States may be obtained if the data in table 2 are adjusted by eliminating the paper constituent and the cardboard, metal, rubber, rags, plastics, and wood in the miscellaneous constituent group, but by including most of the water in the paper (Table 3). Unwrapped residential garbage would have an average moisture content of 70 percent or more.

Acknowledgements—The authors are grateful for the assistance of the following individuals at the Department of Civil and Sanitary Engineering, Michigan State University: Dr. J. R. Snell, Head of the Department; Dr. R. F. McCauley, Associate Professor; and W. Turney, Graduate Student.

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Pavement Maintenance Low on New Hampshire Turnpike

The Asphalt Institute cites the maintenance record of the New Hampshire Turnpike as "a remarkable demonstration of the long-term economy of a modern heavy-duty asphalt pavement."

Data from the New Hampshire Department of Public Works and Highways reveals that the 14.7-mile toll road has cost only $2,651.06 for pavement maintenance during the first five years of its existence. The average expenditure for this budget item has been $530.21, or only $36.07 per mile on a four-lane divided superhighway that has carried 14,520,723 vehicles in this period. Normal annual highway pavement maintenance costs from $50 up to $500 per mile.

Alvin S. Wellborn, Chief Engineer of the Institute, points out "The asphalt-paved turnpike or superhighway is a fairly recent development. The New Hampshire Turnpike, which links the Maine Turnpike with the Newburyport Turnpike in Massachusetts, is one of our older asphalt toll roads. The fact that the New Hampshire Turnpike can offer such an astonishing record of maintenance economy is very gratifying to us and it must offer tremendous reassurance to other states where asphalt-paved turnpikes or expressways are in the works."

FINANCING an 18 Mile SANITARY SEWER

● **TOUGH excavation; sheeting needed; crushed stone is used for pipe bedding.**

INSTALLATION OF more than 18 miles of vitrified clay sewers, begun in May, 1955, is nearing completion in Catasauqua, Pa. Along with a new sewage treatment plant, the total cost will be approximately $1,850,000. Gannett Fleming Corddry and Carpenter, Inc., of Harrisburg are engineers for the program. S. I. Zack, chief, sanitary division of the engineering firm, summarizes the work and background along these lines:

Municipal authority bonds in the amount of $1,850,000 were issued to finance construction of a complete system of lateral, trunk and intercepting sewers, including service connections and a complete high rate recirculation trickling filter plant for sewage treatment. At the same time, North Catasauqua has financed and is constructing its sewage collection system, sewage from which is to be delivered to the Catasauqua sewage treatment plant for eventual disposal.

The treatment plant is designed for an estimated future population of about 10,600 persons, an average sewage flow of 1.6 mgd, expected in 1975 and a peak flow of 5.1 mgd. The sewage flow is gravity throughout. Industrial wastes from a brewery and a finishing and dyeing works will also be handled. The plant provides for a population of some 4,000 persons in North Catasauqua, with an average sewage flow of 480,000 gpd.

Service connections to the curb, lateral, trunk and intercepting sewers are included in the project. Plans and specifications provide for about 75,000 feet of sewers ranging in size from eight to 27-inch, and 22,000 feet of 6-inch service connections, for a total of about 97,000 feet. Of this amount, 71,500 feet will be vitrified clay pipe, some extra strength, ranging in diameter from eight to 24 inches. Contracts call for completion of the general, plumbing, heating and electrical work of the treatment plant within a period of 365 days, and of the sewer system within a period of 480 days.

Following is an outline of the methods whereby revenues for interest, amortization of bond issue and for operation, maintenance and repairs of the project will be obtained:

(1) Through a front foot assessment amounting to $4.00 per front foot, except that for properties having streets or alleys on more than one side, the feet of property frontage for purpose of assessment is to be calculated on the basis of the frontage of the one side, plus 25 percent of all other sides of the property.

(2) A connection fee amounting to $50 per connection.

(3) Annual sewer rentals based on fixtures used, amounting to about $42 per dwelling unit. This rental may be reduced in the future to an average of about $38 per dwelling unit if the state subsidy is received, and as a result a discount is allowed in billing. Sewer rentals for commercial establishments will range from $50 to $150 per year, depending on the nature of the business of the establishment.

The bond issue for the $1,850,000 needed was made up of about $350,000 in short (about six years) maturity bonds, bearing an interest rate of about 2¼ percent; the remainder was in long (40 years) maturity bonds, bearing interest of about 3¼ percent. The short maturity bonds will be amortized from funds received from front foot assessments, and the long maturity bonds will be retired from sewer rental revenues.

Sewer Service Fees

Catasauqua will receive annual payments, pro-rated according to population and flow, from North Catasauqua for sewer services. Such payment will cover the latter's proportionate share of annual, fixed and operating expenses.

Ditching was of rather unusual character. In places, trench depths of 20 feet or more were necessary; old, unlisted water lines were encountered; pumping of water seepage was necessary; blasting was employed in difficult, rocky terrain; and air-powered digging tools were commonly used. Under such conditions, even modern equipment performed well to keep the program moving on schedule.

Some of the construction or installation firms involved were Ben Construction Company, Pittsburgh; and D. & C. Spinosa Company of Allentown, Pa.

● **STARTING interceptor line; vitrified clay pipe is stacked in foreground.**

ELM FOR CITY PLANTING IS RESISTANT TO DISEASE

RALPH B. BRYAN

DISCUSSING THE background of the American elm and its proved attributes of appearance and durability as a city shade tree, Jos. A. Dietrich, park superintendent and tree warden of Greenwich, Conn., at a recent Illinois conference of municipal and park officials in Chicago, asked "Where can you find a suitable tree to replace the American elm in our cities?"

That is a fair question, for the elm tree has a record of more than 60 million years of existence, geologists state, and its importance on the highways and byways of America is older than the nation itself. The elm tree really needs no defense against undue apprehensions. It speaks for itself. It has many desirable characteristics that are found in no other variety. Statistics show that, even in so-called epidemic areas of Dutch elm disease and phloem necrosis, total loss of elms from all causes is lower in percentage than the total loss of other trees from all causes; and in the vast majority of communities, elm trees prosper far better than most other trees.

Furthermore, from the ancestral elms of the past have been developed in recent years new generations and healthy young varieties that thrive under new living conditions created by new generations of humans. The Vase Elm, Moline Elm, and Augustine Ascending Elm are good examples of healthy new varieties of American elm most popular today for street plantings.

City trees are subjected to restraints and pressures of urban life, confined in surroundings of towering stone and steel structures, restricted by paved streets and walks, contested in growth by overhead and underground utilities, and challenged by smokes and gases in the atmosphere and moisture deficiencies in the soil. Yet they thrive in such disciplined conditions — above subways in New York and Chicago and in congested business centers of hundreds of cities and towns, contributing greatly to both human and property values.

● **THESE mature Augustine Ascending Elms in Normal, Ill., are typical. Growth is very rapid; the tree is resistant to Dutch Elm disease, phloem necrosis, etc.**

One of the most popular trees for city planting today is the Augustine Ascending Elm, although it was released for general planting only in the fall of 1949. It has been accepted by over 200 municipalities in 36 states and specified in the landscaping codes of some. More than 50,000 trees were planted in less than six years, mostly in urban areas.

The new variety was developed from scions of a parent mutation of American elm discovered some 20 years ago in Normal, Illinois, by the late Archie Augustine, noted nurseryman and national authority on development of modern plant varieties.

Upon Mr. Augustine's death in 1947, development of the new elm was undertaken by an association including members of the Augustine family and experienced tree growers. Root grafted scions were tested in both field and laboratory in various parts of the country.

Every tree now bearing the Augustine Ascending Elm tag is backed by this 20 years of research and development work, is propagated by tested methods, and is grown under constant control of the association. Every tree that has been distributed is registered by number with the association and periodic experience reports are gathered to form a continuing experience check.

The tree has amazing adaptability to environment wherever planted. The tree grows about 40 percent faster than other varieties of elm and attainment of valuable growth is thus expedited. Only ordinary planting and growing care is required. Users report exceptionally low loss in transplanting and virtually none after the trees have been established one season.

Reports of storm damage have been nil, although thousands of these trees have been subjected to record breaking snow, ice, and wind storms and hurricanes that have destroyed or badly damaged other varieties in the same areas.

It has also been established that Augustine Ascending Elms are unusually healthy and have experienced minimum effects of insect damage. Not a single case of Dutch elm disease, phloem necrosis, or similar ailment has been reported by Augustine Ascending Elm owners. This is in spite of the fact that thousands of these trees are thriving as direct replacements for trees lost by disease. No claim for immunity is made for the tree, since it is impossible to prove conclusively immunity without years of growing experience, but some buyers have made private investigations of the tree's health, and obtained assurance similar to that resulting from the Association's prolonged studies of disease resistance records.

The Augustine Ascending Elm is characterized by its upright columnar form, with strong trunks, crotches and branch system, large foliage, and a compact powerful root system. The tree's form is graceful and modern, giving substantial shade but permitting the sun to reach surrounding lawns and foliage, thereby eliminating the common plague of shade damage.

The compact root system reaches deep into the soil to obtain maximum moisture supply and provide strong anchorage. This compactness also insures minimum interference with underground utilities and mains, and compactness of the tree form gives least interference with overhead utilities and adjacent structures. Pavements and lawns are not raised by the roots, as frequently happens with other elm varieties.

Traffic considerations are important in present day planting. Varieties which obstruct vision or which distribute seeds or leaves over broad stretches of pavement in wet weather are definite hazards. The compactness of Augustine Ascending Elm allows greatest visibility for motorists as the tree is maturing. Later, low branches may be pruned, if desired, without affecting the form of the tree. It bears no seed and is therefore a clean tree in the spring, and it sheds leaves in a confined area in the fall.

Augustine Ascending Elms have been planted in parkways, pavement openings, median strips, and roadsides of streets and highways. For parkway planting, it is recommended that the trees be spaced 35 to 60 feet apart, depending on surroundings and results desired. They grow to a natural height of about 50 feet at maturity in 10 to 15 years. Normal life expectancy cannot be determined as the variety as a whole is still in its youth, but it is believed that it will exceed that of other elms because of its health and adaptability.

● **YOUNG Augustine Ascending Elms are planted in a parkway. The trees bear no seeds and allow maximum visibility for motorists. Trees grow to 50 ft. in 15 years.**

● **TREE planting in the central business district of Winnetka, Ill., was sponsored by the local Garden Club. Trees should be spaced at 35 to 60-ft. intervals.**

PREFABRICATED CATCH BASIN SECTIONS SAVE TIME and MONEY

A. J. MAIR

CATCH BASINS being built in the City of Edmonton, Canada, have a new look about them that is saving time during construction, that is saving the taxpayers money, and that is popular with the crews that build them. The difference isn't apparent in the finished basin, but it is there in the form of prefabricated concrete sections that are giving real savings to the city.

Catch basins are of a different type and of different design in practically every city, but basically the idea is the same in them all. Edmonton's Engineering Department usually built theirs of two pieces of 21-inch concrete sewer pipe, standing vertically on a concrete base, and with a row of manhole blocks around the top on which the castings were placed. This row of blocks allowed for variations in ultimate street grades. The problems encountered in developing this system were small and not too troublesome.

Some thought had been given to precast sections for the basins, but the problem of heavy sections always arose. The cost of special handling equipment would have more than offset any saving made in the new operation. It wasn't until one day during an office conversation on the subject that the idea of a two-piece base was conceived, and after that it was only a short time before test sections were out on the job. It was immediately apparent that the idea was a sound one. So sound, in fact, that Edmonton has applied for patent rights on the sections.

Under the old system of construction, the excavation for the basin was completed and a concrete base poured for the bottom. Three manhole blocks were incorporated in the concrete base to give support to the pipes forming the barrel of the basin, and the base was shaped to a suitable cross-section as well as possible. Normally, the barrel was constructed before the base had firmly set and the manhole blocks were the chief support for the heavy pipe sections until this concrete had completely hardened. When the barrel was just below the ground surface, backfilling was carried out and a ring or collar of mortar placed around the top of the last pipe. On this collar of mortar was placed a complete ring of manhole blocks which were carefully leveled, and the desired type of casting placed on the ring of blocks.

The completed catch basin was simple in construction, sturdy, and effective. Basically there was no need to change the design. But by using simple precast sections, it is possible to obtain the same catch basin in considerably less time.

The saving in man-hours on the job is important in itself, and, added to the reduced time streets are barricaded off, the shorter intervals that motorists have to duck around open ditches, and the fact that a neater job is left behind, makes for a job that impresses residents.

Two distinct sections are cast in the department yard by off-seasonal personnel. They are firstly, a ring, so designed that on one side it seats itself on either the tongue or groove of an up-ended 21-inch pipe, and secondly a plug which can be mortared into this ring giving a solid base.

In construction in the field the excavation is completed as before. But instead of workmen mixing concrete on the job or waiting for a load of ready mixed concrete to arrive, they pick up the pieces of the catch basin already delivered to the site and proceed with their construction.

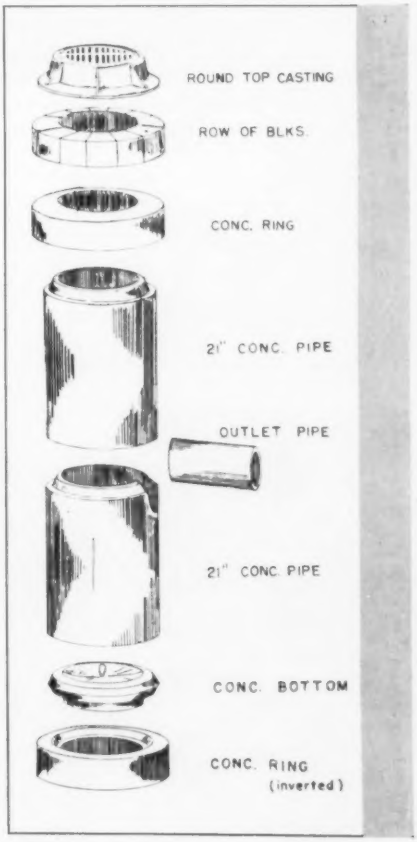
First they place one of the ring sections at the bottom of the excavation, beveled side up. Next, a plug is placed in the hole in the ring and the two pieces are levelled. Incidentally, the plug is cast with a handling ring on the top side to facilitate the operation. Next, the pipe sections are lowered into the excavation and mortared to the base. The outlet pipe is laid in place, the joint mortared, and the barrel continued up to the ground level.

While the outside of the barrel is being backfilled, the last precast section is added. It is another ring, exactly the same as the one at the bottom, this time beveled side down to fit over the top of the last pipe. The basin is then ready for the ring of blocks in case of future adjustment and the castings are placed.

Both the rings and plugs weigh very close to two hundred and thirty pounds, and with the eye cast in the plug section, are easily handled.

As previously mentioned, the sections are cast in one of the department's district yards during off-season periods. It has been found that two men working with a quarter-yard mixer can manufacture twenty-two articles comfortably in one 8-hour shift.

Estimating costs of material only, J. Poppett, the designer, finds that very close to the same amount of material is used in either the old or new system of construction. How-



● **COMPONENTS of a typical catch basin using prefabricated sections, as designed by the City of Edmonton.**

● CATCH BASIN barrel consists of a section of 21-inch concrete pipe. Here barrel is set and partially backfilled.

● OLD METHOD of preparing for blocks and casting required placement of a ring of mortar around top of barrel.

● NEW SYSTEM uses a precast ring which seats on top of the concrete pipe barrel. The ring weighs about 230 pounds.

● LEVELING top ring. With new system there is no need to wait for concrete collar to harden before placing blocks.

ever, on the labor side of the cost story, he finds that assembly costs for the catch basins have dropped to approximately $16 each. This represents a saving varying from $25 to $35. Edmonton's program for the last two years has averaged about nine hundred catch basins per year, some being built under contract and some by City forces.

This coming construction season will be the first time the new sections will be offered to contractors for use on City projects. The idea proved so popular with City crews that the supply fell behind the demand. Foremen found their men insisting on the "new rings", a situation a little unusual when new ideas are first field tested.

The idea was conceived and the tests supervised by the department's cost inspector, J. Poppett, and the program is heartily endorsed by City Engineer J. D. A. Macdonald.

Thus an apparently simple idea is minimizing public inconvenience on road construction jobs and is giving the taxpayer a real saving on every catch basin constructed.

How Much Paint to Stripe a Mile?

Most states use approximately the same amount of paint per mile of striping and approximately the same amount of reflectorized glass beads per gallon of paint.

Virginia reports that it takes about 15 gallons of white traffic paint for each mile of striping. They estimate that 1 gallon of paint is needed for approximately 330 lineal feet of solid white line, 4 inches wide. Glass beads for reflectorized paint average about 6 pounds per gallon of white paint.

The Ohio Highway Department's Bureau of Traffic says that the highway centerlines in that state are in alternating 15-foot dashes and approximately 7 gallons of white paint per mile is necessary. Yellow no-passing lines are continuous and require an estimated 15 gallons per mile. All pavement marking is reflectorized, and 90 pounds of glass beads are used in each mile of continuous striping.

It takes 21.3 gallons of white and 21.4 gallons of yellow paint per mile, 4 inches wide, for striping activities in Missouri. It requires 109 pounds of glass beads for the white paint and 126 pounds for the yellow paint per mile of striping.

The State of Washington specifies 18 gallons of paint per mile for a 4-inch strip. The same amount is specified regardless of color. Glass beads are used with the paint both mixed in the paint and dropped on top. The beads are added in addition to the basic amount of paint at such a rate as to give a ratio of 6 pounds of beads for each gallon of paint used. The same sized beads are used for premix and drop-on.

MECHANICAL COMPOSTING of GARBAGE and SEWAGE SLUDGE

JOHN GRINDROD
Maiwand, New Milton
Hants, England

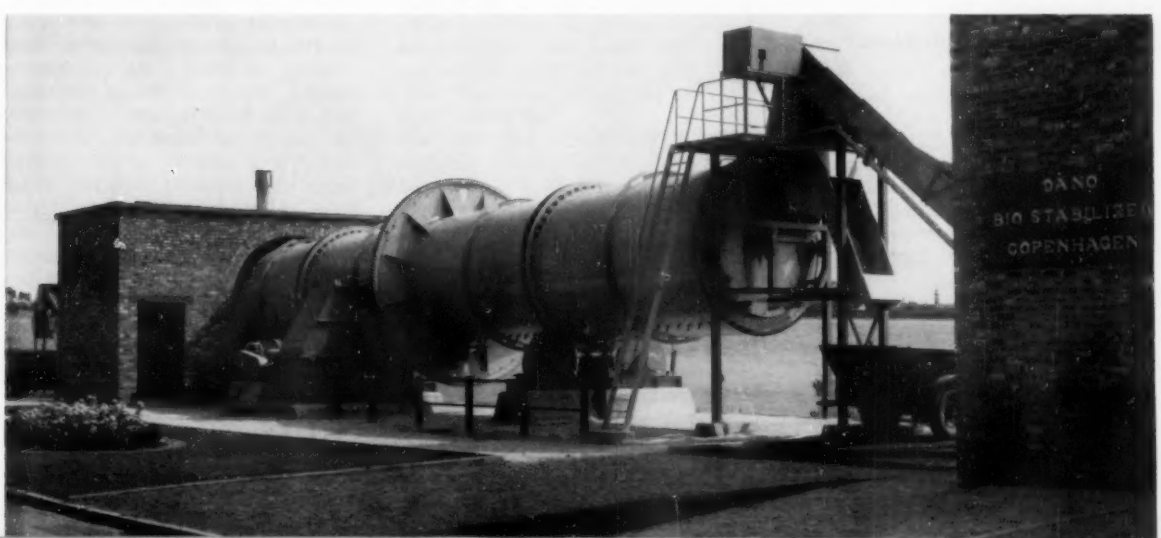
KNOWN AS THE Dano-Bio-Stabilizer, a new fully automatic and mechanized plant for the composting of garbage and sewage sludge has been developed in Europe by the Dane Ingeniorforretning og Maskinfabrik, of Copenhagen. Capable of producing a stabilized product in three to five days, compared with as many months taken to produce compost by older methods, the new equipment requires little maintenance because there are no grinding parts exposed to excessive wear; and, in addition, labor requirements are low since all handling is fully automatic from receipt of the garbage to delivery of the compost and tailings.

Not only does the new development make it possible for local authorities to solve hygienically the problem of garbage disposal but it makes possible the maintenance of the cycle of life.

The Dano Works of Copenhagen initially treated the refuse in a rotating Dano-Silo, where it was thoroughly mixed and homogenized. It was then passed into a rotating Dano-Egsetor where it was ground and screened. The resultant material was then fermented in stockpiles for from three to six months. These plants, which have been supplied to many European countries, have proved to be effective in operation, but the biological treatment of the unfermented compost in stockpiles is extravagant in space, time and labor.

With a view to accelerating the decomposition of the wastes the Dano laboratory began investigations into the process involved by measuring the rate of oxygen consumption and carbon dioxide production, at the same time observing the influence of temperature, acidity and inoculation on the rate of decomposition of different waste materials. These revealed that when the most favorable conditions for rapid decomposition were established and maintained the main part of the process could be completed within a few days. For instance, 200 lbs. of raw refuse were allowed to decompose in a rotating drum. The time in days and the volume of air introduced into the rotating wastes in cubic meters were plotted on the horizontal axis of a graph and the temperatures and the rate of oxygen consumption and carbon dioxide production were plotted on the vertical axis. The rapid drop in carbon dioxide production after three days was interpreted as proof that a usable compost had been produced. This assumption was tested in germination and growth experiments with various seeds and young plants placed in beds containing one part garden soil and one part compost produced from refuse which had been treated for one, two, three, four and five days. These experiments established that germination and growth were normal as soon as the rate of carbon dioxide production in the compost added to the soil was below the rate obtained after 3½ days of treatment.

Following the success of these experiments in which such rapid fermentation was achieved by the simple expedient of maintaining the circulation of air within the mass of wastes, the Dano-Bio-Stabilizer was evolved. It is a long, slowly rotating drum which is charged with raw refuse through a feeding device at one end. Along the whole length of the drum, air is blown into the mass of garbage through nozzles, by the regulation of which aerobic conditions are created throughout. Continuous mixing of the material at an optimum temperature of 110 to 130° F., together with aeration and humidification, brings the first and main phase of the composting to an end within three to five days, during which time the material has slowly moved to the delivery end of the drum and is discharged as compost, the fermented materials being screened out. Laboratory experiments proved that inoculation and the addition of lime was of no value to the composting process. Temperatures of 150° F., which are lethal



● **VIEW OF the Edinburgh installation as seen from the feed end of the drum. This plant handles 20 tons of crude refuse per day, producing 14 tons of compost.**

to pathogenic organisms, can be obtained as required.

In this new process the raw garbage is treated without any previous mixing, grinding or sorting. The grinding effect, which is especially suitable for exposing new surfaces and for the propagation of bacteria on these, is obtained, not by the lifting and falling of the particles, but exclusively by the internal friction. The grinding, fermentation and turning is carried out simultaneously in one single continuous process, leaving only the easy job of screening the disintegrated and fermented material into fine compost and tailings, which are now inoffensive and can be sorted effectively under hygienic conditions.

During the process of decomposition in the Dano-Bio-Stabilizer heat is developed at a rate proportional to the carbon dioxide production. The heat produced is more than is required to develop and maintain high temperatures in the compost and the excess heat is carried off as water vapor in the exhaust air. Consequently, the materials in the drum tend to dry out and fermentation actually stops if the decomposing mass is not moistened.

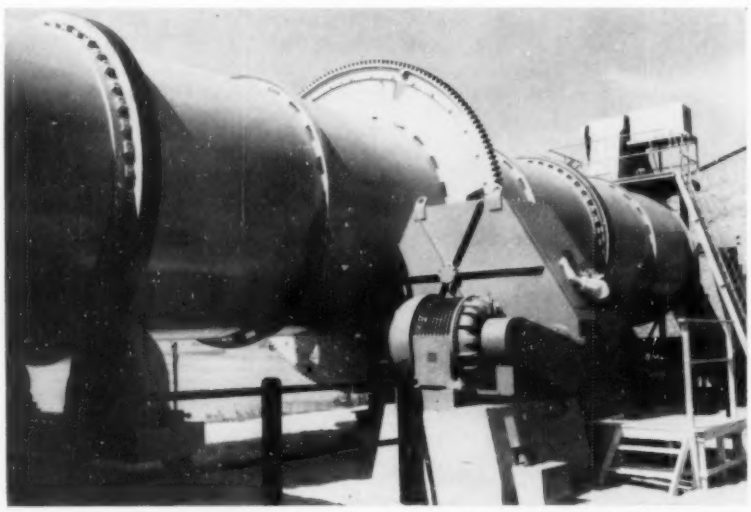
To balance the moisture content and also to provide for the addition of valuable amounts of organic nitrogen, wet sewage sludge can be included along with the garbage. A heat balance calculation shows that, under favorable circumstances, liquid primary sludge, which is digested and contains no more than 90 percent water, can be added to its own weight of garbage and yield a compost with correct moisture content. Under such conditions the garbage from a certain population can absorb and evaporate during composting the sludge from the same population, enriching the compost and pasteurizing and drying the sludge at small cost.

The Edinburgh Plant

The first of these plants to be erected outside the Dano factory is now operating at Rüschlikon, near Zurich, Switzerland. This has a capacity of five tons of garbage per day, while a 20-ton-per-day garbage plus sludge plant has recently been installed at Edinburgh, Scotland, by the city's Lighting and Cleansing Department.

At the intake end of the Edinburgh plant a garbage receiving hopper is fitted with a conveyor which delivers the refuse to a rubber belt, which, in turn, transfers it to a feeding device at which the sewage sludge is added. Here, the mixture of garbage and sludge is introduced into the drum of the Dano-Bio-Stabilizer, through which, in a screw path, the material moves to the opposite end where conveyor belts transfer the treated material from the drum to a vibrating screen. At the point of delivery to the screen metal scrap is extracted and dropped into a hopper for baling. The screened compost is transferred by conveyor belt to storage hoppers or is loaded directly on to vehicles, while the materials retained on the screen are either recirculated by conveyor belt or transferred to an incinerator for burning.

Both the Rüschlikon and Edinburgh plants were designed for a retention period of five to six days during which time the raw materials are stabilized and a compost suitable for use without further treatment is produced. Since the fermentation process is more than half completed after two days, however, the plant may be operated with this shorter retention period, allowing the weight of refuse treated each day to be more than doubled. Though the materials thus treated are not completely fermented they are effectively pasteurized and the combined biological and mechanical treatment disintegrates the material to produce a high yield of compost, which requires only a further short fermenting period for maturing. The largest Dano-Bio-Stabilizer unit can subject 50 to 75 tons of refuse per day to biological disintegration and larger plants can consist of two or more stabilizing units and one or more screening units.



● **THIS IS the Dano-Bio-Stabilizer installed at Edinburgh, Scotland. The illustration shows the electrically driven mechanism by which the drum is revolved very slowly. A report on the operation of this plant appears on this page and the next.**

Operation at Edinburgh

For operation of the Edinburgh plant, 12 man hours per day are required, exclusive of transport. A further report on the operations of the Edinburgh installation has been forwarded under date of Jan. 14, 1956 by N. Y. Wilson, Engineer and Manager, Lighting and Cleansing Dept. of that city, as follows:

1. This plant, which was installed at Seafield at a cost of £36,000, has been in continuous operation since it was officially opened by the Minister of State on 22 July, 1955, and its efficiency can now be confidently assessed.

2. It will be remembered that, under the terms of the contract, the suppliers guaranteed that the plant would be capable of dealing with 100 tons of crude refuse per week, or 20 tons during a normal working day of eight hours. Certain other assurances were also given concerning the labor force required to operate the plant, power consumption and maintenance, apart from the quality of material and workmanship involved in the various items of equipment supplied, which were seen to be first class during installation.

3. It can now be said that the labor force required is less than was indicated by the suppliers. One man is undertaking all operations between the charging of the crude refuse and the discharge of compost and rejected materials, while power consumption is substantially the

same as was indicated. Such running repairs as have been required have appeared to be due to teething troubles, which were inevitable and, invariably, the suppliers have accepted responsibility for the cost of making the necessary repairs or modifications to the defective appliances. The remaining maintenance costs have been insignificant and come well within the anticipated figure.

4. Within a matter of weeks of the plant being brought into operation, it was clear that it also fulfilled the requirements of the specification in respect of capacity. Indeed, during one test period of eight hours, it was charged with 25 tons of crude refuse.

5. When operated on the basis of 20 tons of crude refuse per day, with the addition of sewage sludge at the rate of about 150 gallons per ton of refuse, it has been proved that some 14 tons of fine quality compost and 6 tons of inert, rejected materials could be produced daily, and the hopes and expectations of the plant have been fully realized.

6. The quality of the compost produced has proved acceptable to farmers and gardeners. It is being taken up as it is produced at a price of £2 per ton, ex works and, at the moment, there are outstanding orders for 200 tons. This has been achieved with virtually no sales organization and provides evidence of a large potential market as yet untapped. Much can be said for composting as a means of restoring fertility to agricultural land and as a revenue-producing venture, but its greatest virtue to the Corporation, as Public Health Authority in the City, is that it provides a convenient and hygienic means of treating potentially harmful organic wastes.

7. The immediate success of the Seafield plant in dealing with refuse afforded me the opportunity of experimenting to see how far composting by this method could be applied to the treatment of organic matter produced daily at Powderhall. During the past two months "tailings" (refuse too large to pass through a screen) from Powderhall have been charged into the Seafield plant.

8. The results obtained at first appeared disappointing, as it was found that the tailings could be fed into the plant only at the rate of about one ton per hour, as compared with three tons per hour of crude refuse. This is due to the fact that tailings weigh only 2 cwt. per cubic yard against the 4 cwt. or thereabouts for crude refuse and the chute through which the material is fed into the cylinder restricts the flow of the bulky tailings. An effort was made to overcome this difficulty by charging the cylinder over a period of 16 hours instead of eight but this was only partially successful. An important factor in this particular composting process is the reduction in bulk effected by self grinding as the refuse rotates inside the cylinder. With the bulky tailings and the total absence of cinders and dust, which are important factors in the grinding action, the volume of the tailings could not be reduced quickly, with the result that the cylinder was soon filled and time had to be allowed for a reduction in bulk before charging could be resumed. It was found that only some 10 to 12 tons of tailings could be charged into the cylinder over the period.

9. The problem of treating the tailings clearly introduced factors which were not applicable to the treatment of crude refuse and, in view of the importance of this problem to the City, I presented it to the Managing Director of the Dano Company and have discussed it with him on the occasion of his regular visits during recent months to the plant. Solutions which have been proved in practice at their experimental plant in Copenhagen, and with which I am satisfied, have been found to involve:

(a) The redesign of the inlet to the cylinder, allowing an increased rate of feed.

(b) The insertion of cutting edges at the inlet end of the cylinder, which will hasten the reduction in bulk of the tailings.

(c) An increase in the capacity of the cylinder by 40 percent.

10. These modifications to the plant, as erected at Seafield, provide the Council with a solution to its problem of disposing of the tailings produced at the Powderhall plant, which is the most pressing problem at present confronting the Department.

11. I feel sure that it will be gratifying to know that, apart from being the subject considered at the Autumn meeting of the Institute of Public Cleansing, some sixteen special visits of inspection have been made by local authorities in this country, many of whom are actively preparing schemes on similar lines. A number of visitors from the Continent and the Commonwealth have also been received, and it is of importance that it can be stated categorically that the view always expressed was that this plant pointed the way along which refuse treatment must in the future move.

Table 1—Seasonal Analysis of Crude Refuse by Percentage Edinburgh, Scotland, 1953-1954

Material	*Summer*	*Autumn*	*Winter*	*Spring*	*Average*
Fine dust (under 5/16")	32.41%	38.48%	41.79%	35.96%	37.16%
Small cinders (5/16 to 3/4")	12.80	16.69	19.48	18.80	16.94
Large cinders (over 3/4")	8.02	15.55	16.33	16.79	14.17
Vegetable and putrescible	5.77	3.08	1.62	2.29	3.19
Paper	16.08	11.48	8.71	10.44	11.68
Metals	6.67	4.65	3.29	4.41	4.66
Rags	1.66	0.78	0.53	1.26	1.06
Glass	7.70	4.92	4.01	4.82	5.36
Bones	0.32	0.35	0.23	0.27	0.29
Other combustibles	2.76	1.45	0.63	1.53	1.59
Other incombustibles	5.81	2.57	3.38	3.43	3.80
	100.00%	100.00%	100.00%	100.00%	100.00%
Density of refuse pounds per cubic yard	368	471	555	460	463
Density of dust pounds per cubic yard	988	827	892	809	879
Average weekly output per house—pounds	14.47	29.70	34.64	29.90	27.16

Table 2—Analysis of "Tailings" Percentages by Weight

	Oct., 1950	*May, 1951*
Paper	8.30	10.31
Bones	1.86	1.20
Vegetables	42.64	39.52
Tins	6.67	5.73
Textiles	1.44	2.40
Bottles and Glass	18.46	16.80
Stones	18.64	20.51
Combustible Debris	2.29	3.53

FLY CONTROL for CITIES

CARROLL N. SMITH and J. C. KELLER, Entomology Research Branch, Agricultural Research Service

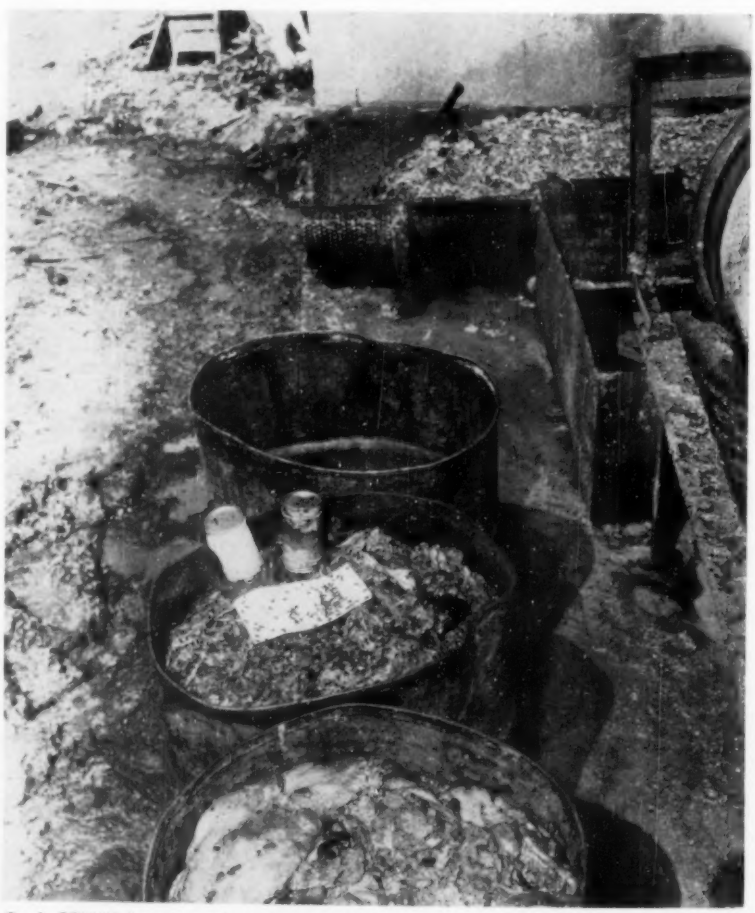
United States Department of Agriculture, Orlando, Florida

AN EFFECTIVE CITY sanitation program is by far the most important factor in fly control. In the modern city the removal and disposal of sewage and garbage are usually done so efficiently that we now take for granted the elimination of almost all the materials in which flies can breed. The fly is a persistent and resourceful enemy, however, and still maintains more than a foothold in most of our cities. Flies that persist in spite of our normal sanitation work must be eliminated by supplementary measures.

A municipality's effort to control flies is often influenced by the attitude of its citizens, which varies with their occupation, experience, education, and early environment. Demands for action often come from localities where flies are so scarce that the vigorous use of an old-fashioned fly swatter in buildings is all that is needed. In other localities flies may be extremely numerous without drawing complaints from their human neighbors. Frequently the public becomes aroused only when threatened by an epidemic. If the threat is the result of a disaster, such as a flood, storm or enemy attack, it is then too late to organize for fly control.

The first step in a concerted attack on flies is to find the breeding sites and eliminate them if possible. Lawn clippings and other green vegetation not properly disposed of can provide excellent breeding media. A little spilled garbage may produce a few flies, and habitual spillage will produce large numbers. Garbage containers with holes or without lids are ideal for fly production. In some cities refuse is allowed to accumulate in the alleys and areaways of the poorer neighborhoods, even though garbage collection and disposal may be well organized elsewhere. Small, unauthorized garbage dumps frequently exist near the boundaries of small cities, and the municipal dump itself may readily be a breeding ground; but flies will not breed in a properly operated sanitary fill. Garbage passed through an incinerator must be completely burned, for half-burned garbage can be a prolific source of flies.

In parts of the city there may be outdoor privies. Pens of domestic animals such as chickens or rabbits may be a source of flies, and suburban livestock or poultry farms may



● A PRIME breeding place for flies. Unsanitary conditions at a rendering plant on the outskirts of a city provides a source for flies for an entire neighborhood.

contribute to the urban fly problems.

A thorough survey, followed by an intensive educational and clean-up campaign, will reduce fly abundance.

Insecticide Baits

In recent years house flies have become resistant to the chlorinated hydrocarbon insecticides such as DDT, lindane, and chlordane. Blow flies, and in some localities house flies, may still be killed with these insecticides, but it is no longer possible to rely on them for long periods of satisfactory control. Recently interest has been shifting to the organic phosphorus insecticides, such as malathion, Diazinon, Bayer L 13/59, Chlorthion, and Shell OS 2046. Baits provide one of the most efficient and economical means of using these materials in many situations.

Baits may be formulated in several ways, each formulation having certain advantages. Choosing the best formulation and applying it properly require alert observation and a little thought. The bait must be applied where the flies usually congregate or feed, which may vary from one location to another. Control will not be obtained unless the bait is attractive and the flies can find it readily. The best bait is the one that will be found most quickly and yet remain in place for the longest time.

A thin liquid bait has been effective against flies feeding on smooth, hard surfaces such as concrete floors or on garbage that contains little paper or other absorbent trash. This bait contains about 10 percent of molasses or sugar and 0.1 or 0.2 percent of the insecticide in water. It can be applied from a garden sprinkling can with about half the holes in the spout covered. For best results 2 to 3 gallons should be used for each 1,000 square feet of breeding or feeding area.

A thick liquid bait containing about 50 percent of molasses and 2 percent of the insecticide has given the best control on garbage dumps, when applied at the rate of 1 gallon per 1,000 square feet of active area. It does not dry in the sun so quickly as thin bait, is not so readily absorbed by soft materials such as paper, and is highly effective against blow flies as well as house flies. The thick bait can also be applied from a sprinkling can, but large dumps are most conveniently treated with a 3-gallon compressed-air sprayer equipped with a cyclone nozzle from which the whirl plate has been removed. Even at sanitary fills this bait may be useful to destroy the flies that will gather on recently dumped loads if there are nearby breeding areas. If not killed, these flies may be dispersed to residential areas when the garbage is covered.

Dry baits consisting of 1 or 2 percent of the insecticide in granulated sugar are convenient for the treatment of areas around garbage cans or animal pens. They may be used inside buildings or in outdoor locations where the flies are feeding on dry surfaces. The method of application is simple: Sift the bait sparsely but widely over the area from a shaker-top can.

Sugar baits melt quickly on damp surfaces or in moist air, and in buildings may be objectionable because of the sticky or crunchy residue on the floor. A granular bait consisting of 1 or 2 percent of the insecticide and 10 percent of powdered sugar on cornmeal lacks these defects and is equally effective. The use of sand in place of cornmeal makes an excellent granular bait for windy, outdoor locations. Apply the scatter-type baits at the rate of 2 to 4 ounces per 1,000 square feet.

Dry baits are particularly useful for treating garbage-collecting areas in alleys. Here flies often gather in large numbers, attracted by spilled garbage or leaky containers, and slip in through the back doors of restaurants, markets, or other food-handling establishments. At front entrances flies collect around empty soft-drink bottles and displays of fruits and vegetables. Systematic treatments with dry baits around the entrances of such establishments are of great help in fly control.

Scattered liquid or dry baits are quickly eaten by the flies, but it is almost impossible for birds, animals, or children to consume a harmful amount. Good, often spectacular, control is usually obtained quickly, but the treatment must be repeated daily, at least for the first few weeks until breeding has been reduced.

● **THICK liquid bait, containing 50 percent molasses and 2 percent insecticide has given good control at refuse dumps. It can be applied with a sprinkling can.**

Contact and Residual Sprays

Some of the organic phosphorus compounds may also be utilized in sprays to control flies by direct contact or through the action of the residues, and formulations containing activated pyrethrins or allethrin are effective as contact sprays in buildings. Malathion has been used at concentrations of 1.25 to 2 percent and Diazinon at 0.5 to 1 percent, prepared from wettable powders or emulsifiable concentrates. Diazinon has given longer residual action than malathion, but is more toxic to mammals. Some investigators have shown that the addition of 2 to 3 percent of sugar or molasses increased the time residues of Diazinon or malathion remained effective. However, in at least one locality under hot, humid conditions residual sprays containing sugar promoted unsightly growth of molds on the walls of buildings.

Residual sprays should be applied to surfaces on which the flies are feeding or congregating at the time of treatment, as well as to their night-time resting places, which may

include the vegetation adjacent to the breeding area. Wettable-powder sprays are not injurious to vegetation, and most emulsions will not cause injury at the stengths recommended; however, emulsions should be used with caution, as the solvent may affect certain ornamental plants. In buildings the walls and ceilings should be sprayed to the point of runoff. Residual spraying is advantageous in garbage-collection areas, particularly in alleys behind food establishments, untended garbage dumps, and animal shelters. In most parts of the United States DDT and other chlorinated hydrocarbon insecticides no longer give residual control of house flies, but they are still widely used in contact sprays in buildings.

A larvicide may be necessary if breeding is found in a medium that cannot be removed. Diazinon has been effective at concentrations of 0.1 to 0.2 percent, when applied at the rate of 5 gallons per 100 square feet. Heavier dosages of malathion are usually required.

Precautions — It is advisable to handle all insecticides with caution. As additional information on the safety of the phosphorus compounds is acquired, greater latitude may be permitted in their use. At the time of writing it seems advisable to remove animals and persons from buildings during treatment. Personnel continuously exposed to the sprays should wear respirators, and those handling the concentrates used to make baits or diluted sprays should wear rubber gloves, avoid contact of the insecticide with the skin, and change clothing daily. Contamination of feed or foodstuffs should be avoided, and insecticides should not be left within reach of animals or children. Freshly whitewashed surfaces should not be treated.

Equipment—No special equipment is required to distribute the poisoned baits, although a 3-gallon sprayer is convenient for the treatment of large garbage dumps. If each garbage truck carries a filled sprayer or can of dry bait, the operator can make an on-the-spot treatment wherever he finds a fly nuisance. In this way inspection and treatment are combined with garbage collection; there is no need for reports and special trips.

Contact sprays are best applied in buildings with atomizer-type sprayers or aerosols, and outdoors with mist blowers. Residual deposits are obtained with wet sprays from compressed-air sprayers or hydraulic sprayers. For treating large areas sprayers of 50 to 300-gallon capacity will be needed. If the problem requires numerous small-spot treatments, it may be more convenient to use a small power sprayer mounted in a motorized sidecar or motor scooter.

Where extremely large areas are to be treated, as in the case of disasters or threatened epidemics, it may be necessary to disperse the insecticide by aircraft. Sprays, liquid baits, and dry baits may all be applied from the air.

Organization— A municipal organization designed to insure adequate control of flies and other insects should provide for an entomologist to supervise and direct the survey and control operations. He should be assisted by a well-trained and reliable staff of sufficient size to insure adequate inspection and treatment. Inexperienced operators will waste a great deal of time and materials through unfamiliarity with fly habits and methods of treatment. Even though baits are less expensive than sprays, their improper use will waste the materials and fail to provide the degree of control desired.

ANALYZING FLOWS in WATER DISTRIBUTION SYSTEMS

ROBERT C. MOORE, The Standard Electric Time Company, Springfield, Massachusetts

BALTIMORE AND Philadelphia have become the first cities to purchase McIlroy Fluid-Network Analyzers for waterworks analysis. The first unit was installed at Baltimore's Park Terminal Headquarters last November. Philadelphia put its analyzer into operation in January at Water Department offices in City Hall Annex. Waterworks engineers and consultants from both Baltimore and Philadelphia became familiar with the McIlroy analyzer by operating the original unit at Cornell University. The usefulness of the device was readily apparent to these men, and they recommended that analyzers be obtained by their cities. To appreciate the value of an analyzer it is necessary to understand the complex problem confronting the waterworks man and consulting engineer assigned to study a water distribution system network. Let us see just what he is faced with.

If a system never changed in size, shape, or efficiency, it would be possible ultimately to design and maintain an ideal waterworks. In actuality the engineer in most cities is confronted with any or all of the following conditions:

1. A constant growth and shifting of the domestic and industrial water users to outlying areas farthest from the source of supply, where system pressures are usually lowest.

2. A system laid out for a load pattern which hasn't existed for many years.

3. Pipelines whose effective diameters have been decreased by tuberculation or have undergone other material changes.

4. New and greater demands for water for such purposes as fire protection, air conditioning, lawn sprinkling, process cooling and other industrial and domestic uses.

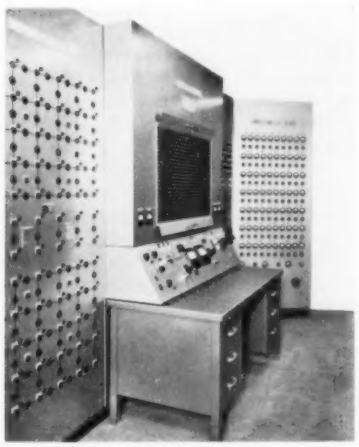
It is the job of the engineer to provide water service as best he can with the facilities available and to recommend new facilities needed for the future. Some of the typical questions he must solve to keep abreast of his problems include:

1. What pressures can be expected at various points in the system under conditions such as: (a) A large fire where water is drawn from many hydrants in a concentrated area; (b) a hot summer day when lawn sprinklers, air conditioning units, the normal system users, and possibly a large fire are all demanding water simultaneously; (c) the addition to the system of a new housing development, factory, or other large water user.

2. Where should new pipelines be installed to increase pressures found to be too low?

3. Which existing pipes in the system should be replaced, repaired or reinforced and what sizes are needed to meet the demands on the system?

4. Should present pumping and storage facilities be increased and if so, how much?



● **ANALYZER for Philadelphia: Left to right, Network Section, Control Section, Source Section and Load Section.**

5. Where should new reservoirs or pumping stations be installed to be of greatest benefit?

To answer such questions, it is necessary to have basic data such as: up-to-date maps of the system showing locations of all pipes, valves, and fittings and their interconnections; records from files and field on the condition of pipes, valves, and other system facilities; meter books and other records of water usage both as to quantity and location in the system; charts from recording gauges showing daily and hourly pressures and flows at pumping stations, reservoirs and key points in the system. Predictions of future growth, the probable demands for water and the areas of special needs must be based on such information.

After the necessary data have been obtained, the engineer may then study the system as a network of interconnected pipelines, loads and sources. The head loss due to friction in a single pipeline with known flow rate can be determined with a hydraulic slide rule or nomograph, or by long-hand solution of the Hazen-Williams Flow Formula. When several hundred such pipelines are interconnected, the determination of head loss becomes infinitely more difficult because the flow rates in the various pipes are not known.

If the engineer could develop a model which behaved exactly like a water system, he could determine flows and pressures by measuring them on the miniature network. The McIlroy Fluid-Network Analyzer is just such a device.

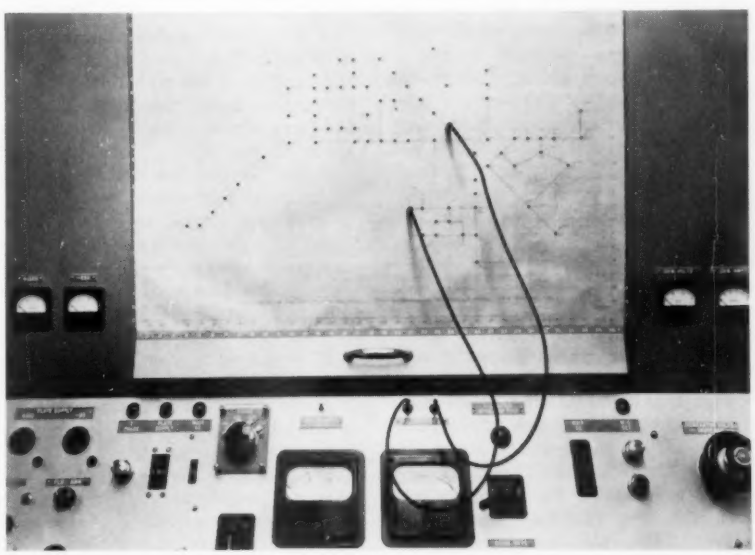
On the McIlroy analyzer each pipeline, area load, and source of water in the system is represented by its electrical equivalent. Electricity flowing through the analyzer is analagous to water flowing in the system pipelines. Voltage drop is proportional to head loss and current is proportional to flow rate. Head loss and flow rate can thus be measured with a voltmeter and ammeter.

The heart of the McIlroy analyzer is a special resistor known as a Fluistor. This device has an electrical characteristic identical to the head loss-flow rate characteristic of a pipeline. The choice of one pipe diameter over another can thus be made by installing an equivalent Fluistor for each size and length of pipeline on the analyzer and metering the resultant pressures and flows.

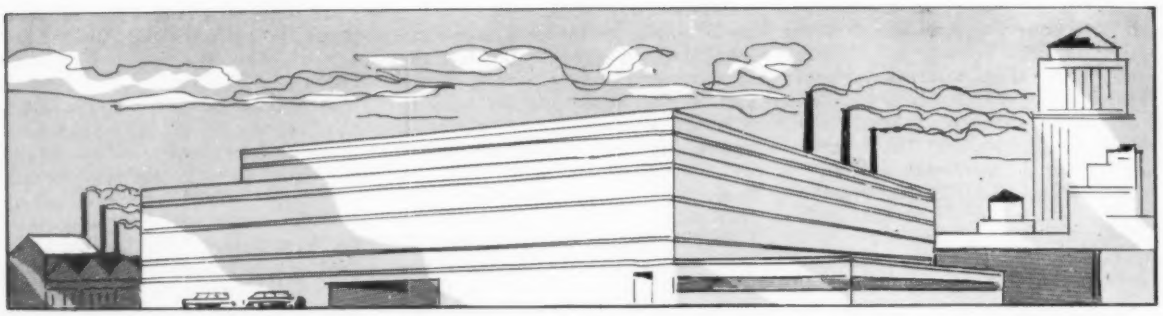
In like manner it is possible to try optional ways of supplying new loads to ascertain the best method to use. Benefits to be obtained from a new reservoir can be determined by adding a source unit at various points on the analyzer network. Electrical equivalents of valves can be opened and closed on the analyzer to note their effect on system operation. All these tests and many more can be made without touching the water system and before one cent is spent on construction.

A recent waterworks analysis is an excellent example of the savings made possible by using the analyzer. Studies of a system by conventional methods had indicated that a new 48-inch main was required to connect two portions of a large network. When the same system was studied in greater detail on a McIlroy analyzer it was impossible to justify more than a 36-inch main in the same location. In the particular city being studied the difference in installed costs of 36-inch and 48-inch main amounts to $20 per running foot. Since 4000 feet of main were involved, a saving of $80,000 in capital investment resulted from the analysis.

The pressing demand for more and better water service makes the McIlroy analyzer of primary interest to every waterworks owner and consulting engineer in the waterworks field.



● **MAP PANEL at the Control Section over which a configuration of an actual pipeline section is placed. Readings of flow and pressure can be taken between any two points of the system and readings made directly in units of head and rates of flow.**



HOW COMMUNITIES *can ATTRACT and hold INDUSTRY*

LLOYD A. DIXON, JR.

Vice President in Charge of

Meter and Valve Division

Rockwell Manufacturing Company

OUR COMPANY has built five major new plants in five different states in the past five years. Yet we could not suggest any universal community formula for "industry appeal." Too many variables are involved. Moreover, our ability to speak as "authorities" on this subject may be limited by the fact that we rely on a professional factory locating service to help us select plant sites. They screen and check locations for us as a process of singling out the ones that seem to meet our advance specifications. Then we collaborate in proving out the final choice, with the Rockwell people involved making the decision.

There are, however, a few simple rules of thumb which should be followed by the leaders of a community seeking new industry.

Most community leaders know they must study the practical, measurable factors which industry considers in plant location. They know they must conduct a thorough survey and appraisal of community assets in terms of these factors. They must accurately measure the community's transportation facilities, labor supply, utilities situation, tax structure, weather conditions, wage rates and availability of good, well-situated ground, among other elements.

Some community "salesmen" forget that industry does not thrive on tax "breaks" and material assets alone. Many companies, such as ours, have learned from experience to look with suspicion on the community whose leaders offer us too much—especially if the inducements are offered even before the identity of our company is revealed.

We shy away from such communities for two reasons: 1) We want to go into a community where we know new industries are carefully screened; and 2) we don't want inordinate tax breaks which, in effect, may come out of the pockets of other industry already in the town. Only one of the five communities in which we have recently built plants has given us a substantial tax inducement. This was done by voluntary action of the residents—not by forcing an extra tax burden on an industry already there. A point in favor of our choice here was that our tax position could be expected to be relatively stable.

Thus our stand on taxes boils down to this: We want to pay our fair share wherever we go, as partners in the future of each community and state in which we operate.

Like most other companies, Rockwell is geared to steady growth over the long pull. We naturally want to become part of communities with a sound, far-sighted philosophy of industrial development.

We want to be reasonably sure that a community isn't bringing in industry wholesale without regard to the effect each new plant may have on the others, or on the community as a whole. Some of our operating divisions require a high proportion of skilled employees. If the availability of skilled workers in a community is limited or even average, we want to make certain our employee force will be stable and can be maintained with fairness to all.

Another aspect of our screening standards is community "Personality and Policy." For example, we like to feel reasonably sure that a community where we locate will discourage the arrival of industries with unusually poor labor relations histories—such as a record of major strikes every year for many years. Restiveness and disharmony in personnel matters do affect other industry in the area, even the "happiest" companies.

The Intangibles of Plant Location

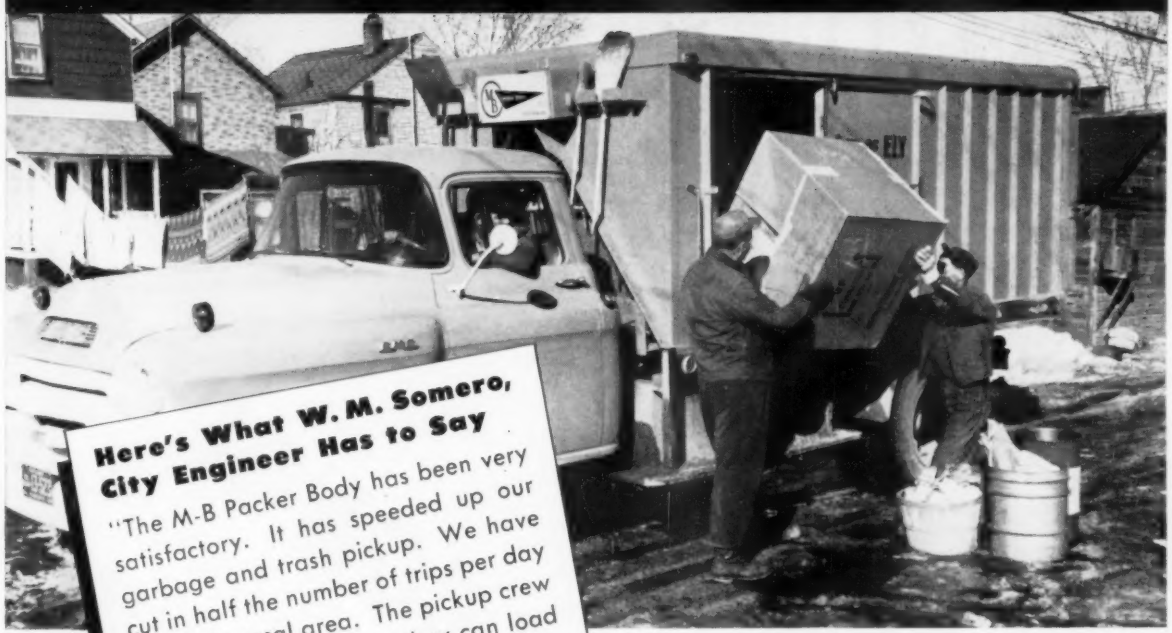
Our major problem and concern in plant location boils down the need to appraise correctly community attitude and what we call "community character."

Determining the material suitability of a community is relatively simple. Our factory locating service generally handles it in line with our specifications. The statistical and other findings of these capable professionals come to us "Recommended Plant Locations."

From that point on, however, it is up to us to satisfy ourselves as to the character of the recommended communities we may choose to "live" with. We find that the same sort of principles used by industry to appraise personnel can be applied in appraising communities, although, naturally, community appraisal is far more complex. With our own past experience in community selection as a background we study a

(*Continued on page* 188)

City of Ely, Minn. ends collection complaints with fast M-B Packer



Here's What W. M. Somero, City Engineer Has to Say

"The M-B Packer Body has been very satisfactory. It has speeded up our garbage and trash pickup. We have cut in half the number of trips per day to the disposal area. The pickup crew likes the body because they can load and handle anything that will go through the large side doors. Our alleys are cleaner and complaints on garbage pickups have ceased to exist."

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Get satisfaction like this on your own routes at a saving in original cost and operating expense. *Compare* the outstanding advantages of the M-B Packer Body with complicated hydraulic-type collection units costing thousands of dollars more. *See the M-B Packer demonstrated on your routes. Send the coupon today for more information and the name of your M-B distributor!*

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Resolutions Committee Named

Newark, New Jersey—Edward P. Decher, Secretary of the Joint Sewer Commission of Newark, New Jersey and President of the American Public Works Association recently named William Hurst, City Engineer, Winnipeg, Canada as chairman of the Association's 1956 Resolutions Committee. Others named to the Committee were: Milton Offner, Secretary, Board of Public Works, Los Angeles, California; Paul Screvane, Director of Operations, Department of Sanitation, New York, N. Y. and Richard F. McBean, Superintendent of Automotive Equipment, Honolulu, Hawaii. Mr. Decher, as President of the Association, serves in an ex-officio capacity as the fifth member of the Committee. The procedure established by the Board of Directors for the adoption of resolutions by the membership calls for the referral of all proposed resolutions to this Committee prior to the annual business meeting. (The 1956 meeting is scheduled for eleven o'clock, Monday morning, September 24, at the Will Rogers Auditorium in Fort Worth, Texas). The Committee will then submit the proposed resolutions, with their recommendation on each, to the membership for official action.

New Parking Manual Issued

Saugatuck, Connecticut—The legal, financial and administrative aspects of America's urban parking problems are discussed in a new 196 page manual recently published by the Eno Foundation For Highway Traffic Control. This new publication was prepared by a Joint Committee On Urban Traffic Congestion and Parking under the chairmanship of Jefferson B. Fordham of Philadelphia, Pennsylvania, who represented the Municipal Law Section of the American Bar Association of the Joint Committee. Other organizations represented on the Committee were: The Eno Foundation, The Institute of Traffic Engineers, National Institute of Municipal Law Officers, American Public Works Association, Automotive Safety Foundation, American Society of Civil Engineers, American Municipal Association, The Investment Bankers Association, American Society of Planning Officials, American Automobile Association, American Transit Association and the Urban Land Institute. The new manual contains a great deal of useful data and ideas for those concerned with the shaping and execution of policy of this field. Copies of this valuable publication will be distributed through the organizations represented on the Joint Committee.

Werner and Caster Head Panels at Ohio Meeting

Cincinnati, Ohio—Well over one hundred members and guests attended the annual meeting of the Ohio Chapter of the APWA, at the new city garage in Cincinnati, on Friday, April 27th. The meeting featured a panel discussion on street maintenance, moderated by R. F. Werner, Chief Engineer of Columbus, Ohio, and a discussion on sanitation led by A. D. Caster, Sewage Disposal Engineer for the City of Cincinnati. C. A. Harrell, City Manager of the host city, welcomed the delegates at the business meeting which preceded a Buffet Luncheon. Members and guests in attendance viewed displays and demonstrations of various types of equipment and also enjoyed the inspection trips that were arranged by T. J. Montgomery, City Engineer of Cincinnati, who served as President of the chapter for the past two years. Charles Horlacher, Administrative Assistant to Dayton's City Manager heads the new slate of officers that was elected at the business meeting. Other officers of the chapter are: Roy J. Fiemeyer, Director of Public Works, Hamilton, Vice President and C. A. Boeke, Director of Public Service, Middletown, Secretary - Treasurer. Additional members elected to serve on the Executive Committee were: W. C. Wichman, Director of Public Works, Cincinnati; Fred M. Hughes, Superintendent of Public Works, Springfield and Ray J. Finn, President, Bone Finn Company of Cincinnati.

Exhibitors Sign Up For Fort Worth Exhibition

Fort Worth, Texas—Leading manufacturers of public works equipment, materials and supplies from all parts of the United States, will display and demonstrate their products to over 1,000 public works officials at the 1956 Public Works Congress and Equipment Show to be held in Fort Worth, September 23-26. C. M. Thelin, Director of Public Works and General Chairman for the event recently announced that eighty-five (85) per cent of the space available for the equipment show is already under contract. Arrangements for the exhibition are being handled by the headquarters staff of the American Public Works Association, 1313 East 60th Street, Chicago, Illinois.

OFFICERS: Edward P. Decher, Newark, N. J., *President;* Frederick W. Crane, Buffalo, N. Y., *Vice President, Eastern Area;* Kenneth K. King, Phoenix, Arizona, *Vice President, Western Area;* Walter M. Swietlik, Milwaukee, Wisconsin, *Vice President, Central Area;* Albert G. Wyler, New Orleans, La., *Vice President, Southern Area.* DIRECTORS: W. D. Hurst, Winnipeg, Manitoba, Canada; Sol Ellenson, Newport News, Virginia; Roy W. McLeese, Salt Lake City, Utah; Jean L. Vincenz, San Diego, California, Warren A. Coolidge, Nashville, Tenn., *Immediate Past President;* Donald F. Herrick, *Executive Director.*

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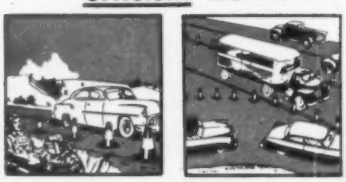

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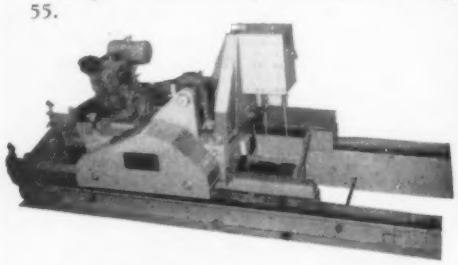

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Construction Lags on Public Water Supplies

Washington, D. C—Capital investment in public water supply facilities must be increased from the present estimated $22.8 billion to $35.7 billion by the end of 1975 if requirements of rapidly increasing uses in the United States are to be met, according to the Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, U. S. Commerce Department. In addition, to off-set obsolescence and loss of useful life in public water systems, and to replace outdated facilities with new construction will require over $6 billion in expenditures to retain the total value invested. A summary of information collected by the Division from all available sources indicates that many inadequacies already exist in water supplies, requiring restrictions on water usage. The cost of constructing adequate reserve facilities for all systems which are now deficient is estimated by the Division to be about $4 billion.

Congress Considers Federal Aid For Sewage Plant Construction

Washington, D. C.—Municipal officials have expressed considerable interest in H. R. 9540 which was introduced in Congress by Representative John A. Blatnik of Minnesota, several weeks ago. The proposed legislation is in the form of an amendment to the present Water Pollution Control Act, and calls for expenditures of up to $1 billion for construction of municipal sewage treatment works. The proposed amendment also provides for a broad-scale attack on water pollution with federal aid for research and federal grants to states to carry on water pollution control programs. The bill is designed to help municipalities meet the huge backlog of sewage treatment plant construction needs which are currently estimated at about $2 billion. Pertinent features of the bill provide that, (1) No grant shall be made unless the project has been approved by the appropriate state water pollution control agency and the Surgeon General of the United States; (2) No grant shall be made for any project exceeding 50 per cent of the total cost of the project of $500,000 whichever is smaller; (3) No grant shall be made until the applicant can offer assurance that the works will be properly operated and maintained after completion of construc-

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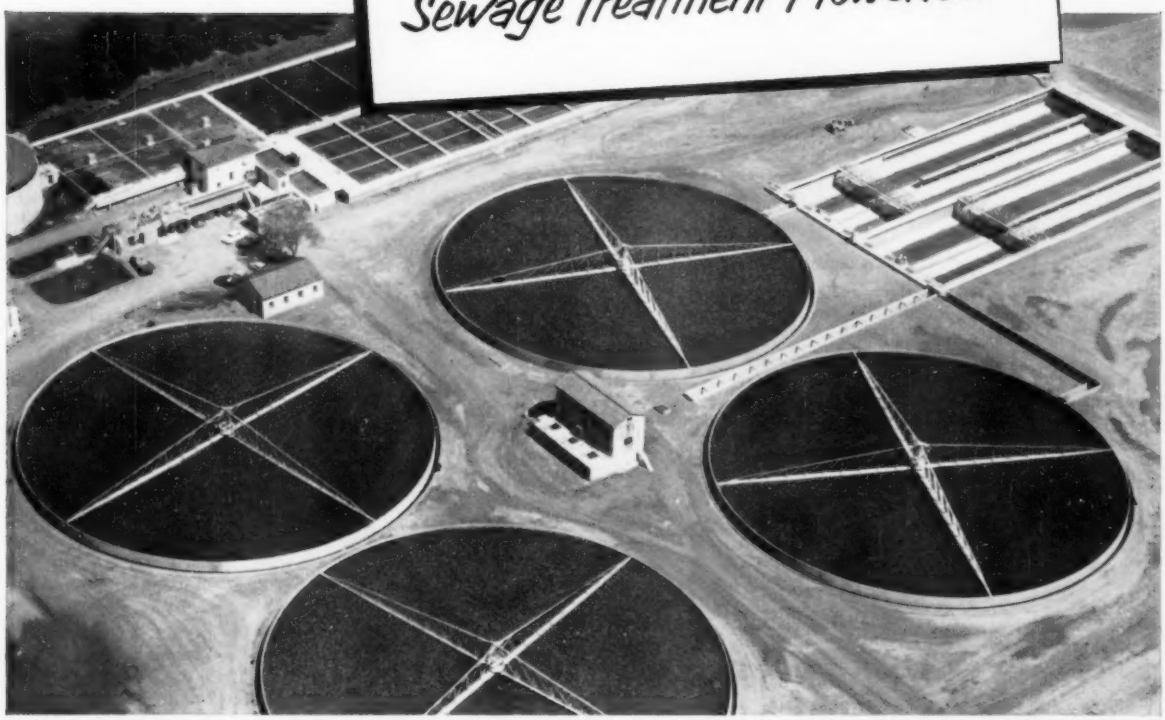

Aerial view of the El Paso plant with the two Monorake units shown at top right.
Consulting Engineers: Ashley G. Clossen & Associates, El Paso, Texas

EL PASO TEXAS Adds Secondary Treatment to Sewage Plant . . . Biofiltration Flowsheet Used

El Paso, rapidly growing Texas city, recently added secondary treatment to its sewage plant employing four Dorrco Distributors followed by two Monorake mechanisms.

The two Monorake units are each installed in a basin 67 ft. 10½″ wide by 245 ft. long. The Distributors, among the largest ever manufactured, are 220 ft. in diameter each capable of handling a maximum flow of 13,900 gpm at 2.75 ft. head.

If you would like more information on the complete line of Dorr-Oliver sewage treatment equipment write to Dorr-Oliver Incorporated, Stamford, Connecticut for Bulletin No. 6041.

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tion; and, (4) No grants shall be made until the applicant has given reasonable assurance that the rates of pay of laborers and mechanics engaged in construction of the project will not be less than the prevailing local wage rates for similar work as determined in accordance with Public Law 403 approved August 30, 1935.

Grants under the Blatnik Bill would be made directly to the cities, towns, counties, districts and to the states and interstate or intercity agencies. The amount authorized for each fiscal year $100 million with the total aggregate appropriation limited to $1 billion. Sums appropriated would be available until they are expended.

State Highway Debt Set At Seven Billion Dollars

Washington, D. C. — The gross state highway debt outstanding at the end of 1955 was approximately $7.1 billion according to a recent release issued by the Highway Research Board. About seventy per cent of this represents toll-revenue obligations. Total bonds issued by the states in 1955, amounted to $1,150 million compared to the $2,317 million issued in the previous year. The big drop was in toll-facility issues which decreased from $2,082 million in 1954 to $842 million in 1955. Toll-free bond issues, however, showed an increase of about $72 million over the 1954 total of $236 million. County and municipal highway and street bond issues totaled $450 million last year.

New Orleans Chapter Elects New Officers

New Orleans, Louisiana—The annual business meeting of the New Orleans Metropolitan Chapter of the American Public Works Association was held on May 1st with President Robert Grehan presiding. One of the highlights of the meeting was the election of officers which resulted in the elevation of S. di Benedetto, Engineer for the Water and Sewer Board from the Secretary-Treasurer's post to the presidency of the chapter. Clarence Palm, Sr., Gas Engineer, for New Orleans Public Service, Inc., was named Vice-President and George Stevenson, District Engineer for the Louisiana State Highway Department was elected Secretary-Treasurer. Guest speaker at the meeting was George Mahoney, Chief of the Planning Section of the consulting engineering firm of Howard, Tammen, Needles and Bergendoff of Kansas City.

Which uses the most water?

Filling Station —or Church Building?

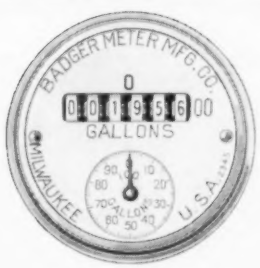
ANSWER: Before one Midwestern community installed water meters, gas stations were billed a flat rate of $12 per year; so were the churches. Last year, the average bill for all filling stations was $48, while in only one case did a church use more water than the minimum charge of $7.20.

Badger water meters provide fair rates for all users – help conserve vital resources – key to the future of your community.

The above is a typical example of how flat-rate water policies are annually depriving water departments of thousands of dollars of revenue. Is this practice — and the *water waste* that goes with it — a problem in your community?

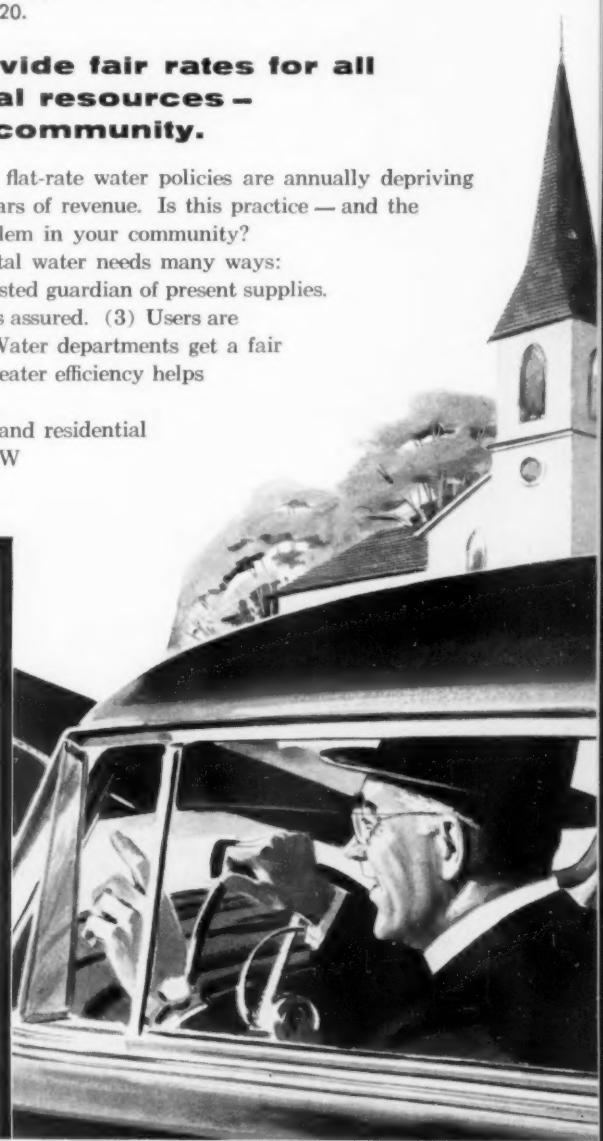
Studies show Badger meters serve vital water needs many ways: (1) Each customer becomes a self-interested guardian of present supplies. (2) A fair allotment of available water is assured. (3) Users are charged for exact amounts used. (4) Water departments get a fair price for water and service. And, (5) greater efficiency helps keep water departments self-supporting.

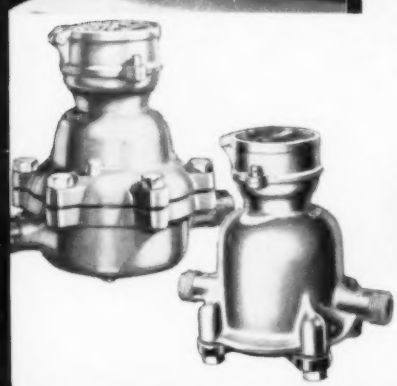
Water is vital to industrial, business and residential development. Make certain you act NOW to safeguard your community's future — specify Badger water meters.



Sensitive registering key to maximum revenue per installation

One of the greatest "business machines" your community can own. Badger water meters are always on duty. Dial accurately registers all flow from the smallest stream to maximum meter capacity. Service records also prove the dependability of Badger meters . . . show why waterworks men agree, "It pays to install Badger meters."





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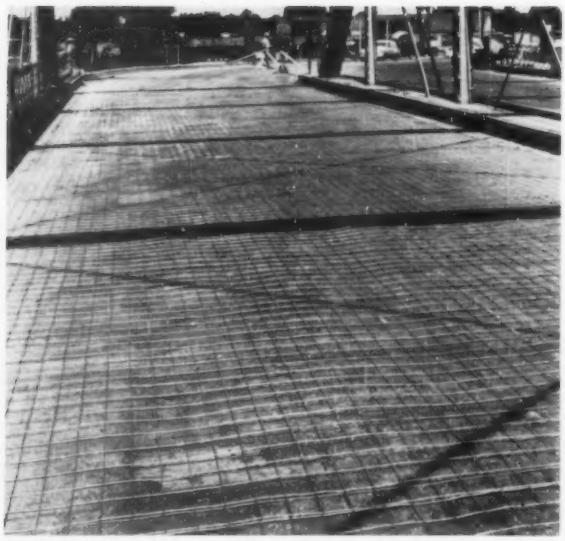

● **START of resurfacing job on Denver's 38th St. bridge. Note the bare spot (foreground) where deck plank is exposed.**

● **COMPLETED project. Placement of wire reinforcement and hot mix were scheduled to keep bridge open at all times.**

Fabric-In-Asphalt Solves Bridge Decking Problem

COLORADO'S DEPARTMENT of Highways, headed by Chief Engineer Mark U. Watrous, has found fabric-in-asphalt satisfactory for bridge deckings.

Two bridge deck resurfacing projects in the Brush-Fort Morgan area pioneered the use of steel welded wire fabric reinforcing of asphaltic concrete. Both were constructed in 1954. The resurfacing placed on the timber deck bridge on State Highway 52 north of Fort Morgan is now in perfect condition, though considerable trouble had been encountered with the surface on this bridge deck in the past.

The second of the two Brush area bridge resurfacing projects, a bridge deck east of Brush across Beaver Creek also was laid using wire reinforcement, and has matched the good performance of the other bridge.

Apparently taking a cue from the Colorado State Highway Department, the City and County of Denver late in 1955 installed fabric-in-asphalt resurfacing on Denver's four-lane 38th Street Bridge across the Platte River. The bridge, approximately 70 years old, had been newly decked several years before with 3 x 8-inch laminated timbers on edge, but due to the vibration of heavy traffic, great difficulty had been experienced in keeping any type of wearing surface on the timbers. Prior to the use of fabric-in-asphalt, the engineers were attempting to get by with a rock chip wearing course over a tack coat.

The reinforcement steel welded wire fabric, style 4 x 4-10/10 (number ten gauge wires on 4-inch centers) was stapled to the bridge floor with 3-inch wood staples. The fabric was supplied to the job in 120 foot long rolls, 12 feet wide. Six mats, 20 feet long, were cut from each roll, and these were placed transversely to the 22-foot wide roadways, with mats overlapping 4 inches for continuity of reinforcement.

The reinforcement mats for the full 220-foot length of one two-lane roadway were placed the first working day. The second day, the roadway was tack-coated and approximately 2½ inches of fairly dense graded hot asphaltic mix applied as surfacing. The mix was tail-gated from trucks and a scraper was used to spread it to the proper depth. The final step was compaction by a roller.

The third working day the fabric was placed on the other roadway, and hot mix applied the fourth day. This scheduling of the work kept the bridge open to traffic at all times. Charles B. Berry, Director of Public Works, initiated the use of fabric reinforcement in the Denver bridge project.

Water-Borne Outbreak of Infectious Hepatitis

FROM INDIA comes a report of an outbreak of infectious hepatitis which occurred in December, 1955, and January 1956, in New Delhi. Total cases reported were in excess of 7,000, but the Director of Health Services for Delhi State estimated the total number of cases at about 35,000 or perhaps considerably more—possibly as much as 20 per cent of the population was affected in some way. The outbreak is noteworthy as probably the first one where coagulated, filtered and chlorinated water was clearly and unmistakably involved.

The total population of Delhi is about 1,800,000. Water is drawn from the Jamuna River, at two points, one at the upstream side of the city, the other downstream about 16 miles. About 700 ft. below the upper intake, a natural drainage line, the Najafgarh Nalla, empties into the Jamuna. Dry weather flow in this line is 15 to 20 cu. ft. per second, and much of this appears to be sewage and polluted waste

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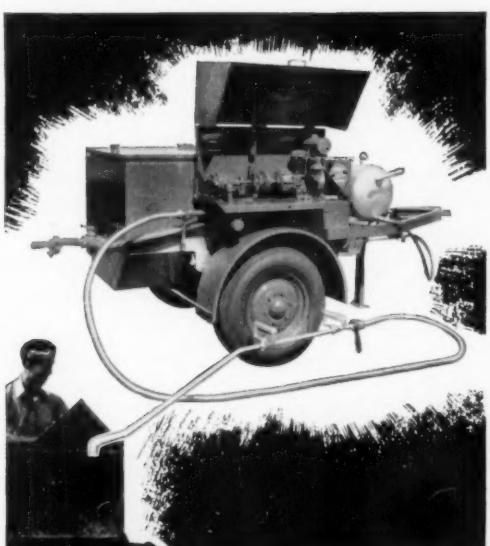

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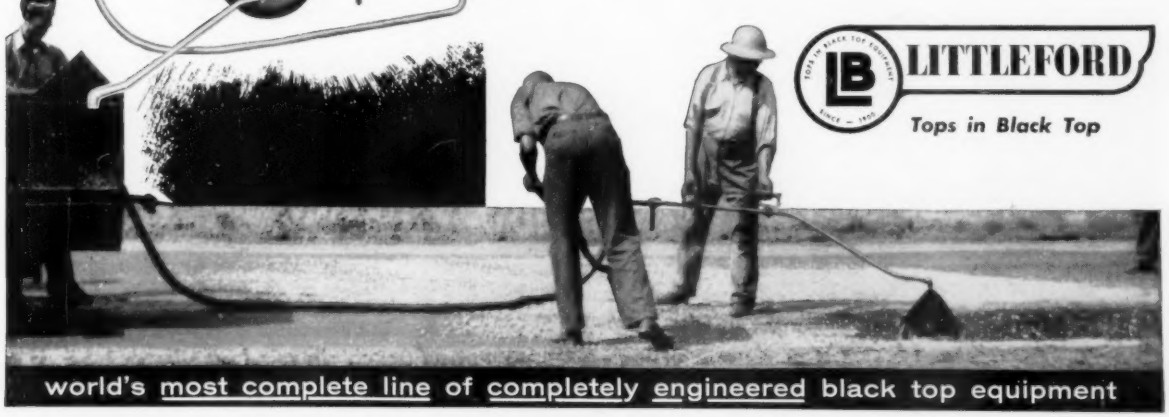

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water. While the maximum flow of the Jamuna is 200,000 sec-ft., dry weather flow is such that channels must be dug in the stream bed to bring water to the intakes, and sometimes diverting dams are needed. In fact, the flow of the river is insufficient during dry months and must be supplemented by irrigation water.

This upper plant supplies 44 to 46 mgd during the winter months and up to 62 mgd during the hot weather. Treatment consists of settling, coagulation, rapid sand filtration and disinfection. Information is not available on the period of sedimentation or the rate of filtration. Normal alum dosages of 0.6 to 0.8 grain per gallon have been used with 0.5 ppm of chlorine.

Water analyses appear to have been performed regularly, both chemical and bacteriological. The latter did not show evidence of pollution and the report states that "throughout the months of November, December and January, the bacteriological analyses do not show any evidence of contamination and the standards of bacteriological purity . . . were fully complied with." But it was further stated "This indeed is an extraordinary state of affairs when one reckons that gross contamination with sewage has been admitted . . ."

The results of chemical analyses gave more pointed evidence of pollution. The chloride content of the raw water from Nov. 1 to Nov. 10 was reported as varying between 5.6 and 5.7 ppm; but on Nov. 11 it was 12.7 ppm; on Nov. 12 it was 25; on the 13th it was 60; on the 14th it was 80; and on the 15th 90 ppm. It was estimated that the influent to the plant at this time was about one-half sewage and one-half river water. This estimate was based on the fact that the flow in Najafgarh Nalla contained about 160 ppm of chlorides. The 12.7 ppm of chlorides in the influent on Nov. 11 indicated a ratio of sewage to Jamuna River water of 1 to 11; on Nov. 14 it was approximately 50:50.

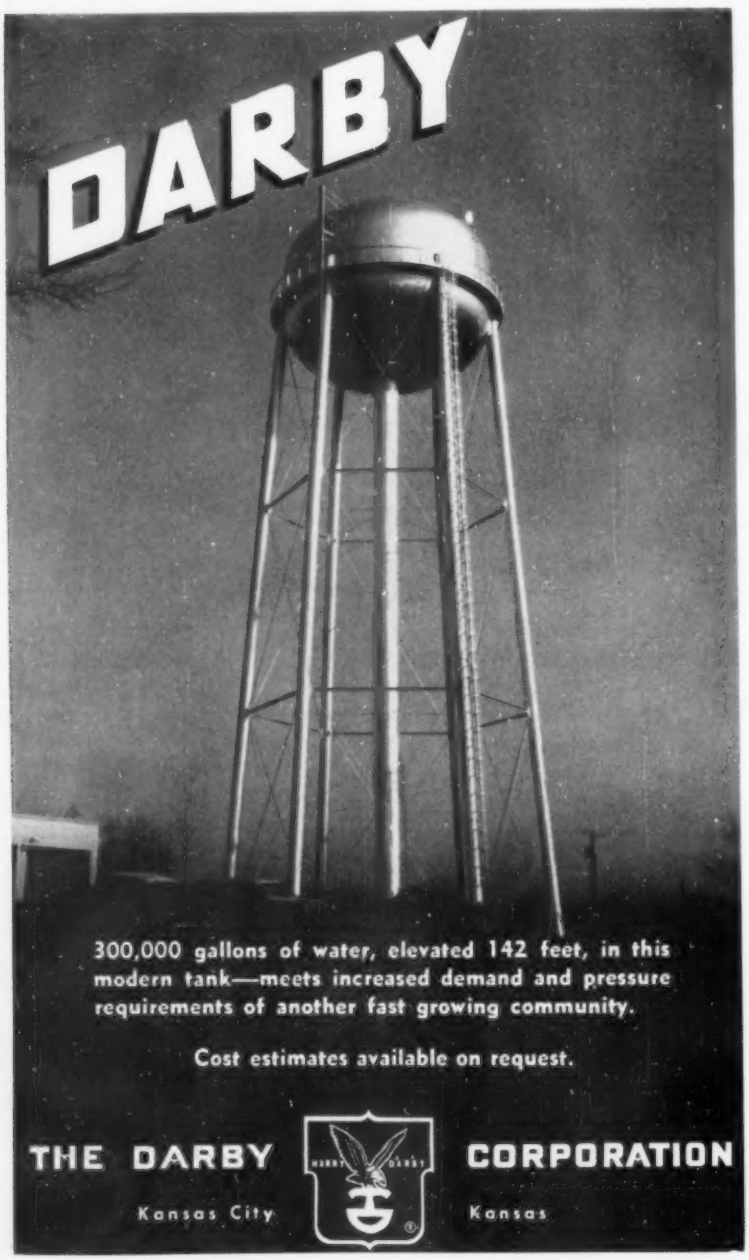
In an attempt to obtain coagulation of this influent liquid, the alum dosage was increased to 2.9 gpg on Nov. 12; to 3.26 gpg the next day; and thereafter it was held at about 3.14 gpg. The chlorine dosage was also increased. This was 0.5 ppm on Nov. 11; 0.63 ppm on Nov. 12; and 1.19 ppm on Nov. 13 giving a reported residual of 0.8 ppm; the Nov. 14 dosage was 1.9 ppm with a residual of 0.7 ppm; this dosage was decreased to 1.8 ppm on the 15th, but was increased to 2.1 ppm on Nov. 16 and lowered to 1.6 ppm giving 0.4 ppm residual on Nov. 17.

The investigation resulting from the epidemic indicated that contamination started to "a very small extent" on Nov. 4 and that "gross contamination" occurred between Nov. 11 and 16. Since practically all of the cases occurred in December and January, the incubation was the normal three to six weeks.

The evidence amassed by the Investigating Committee shows that the outbreak of hepatitis (or jaundice) was viral in origin; that the causative virus was spread through the water supply; and that a heavy flow of sewage contaminated the water drawn into the treatment plant for a period of about a week.

Comment by the Editor of Public Works

This incident is further proof that water can be an important factor in the spread of infectious hepatitis, though from past data it appears likely that spread is also possible by food and perhaps by contact. It further demonstrates that filters do not remove the virus and that, under the conditions existing in Delhi,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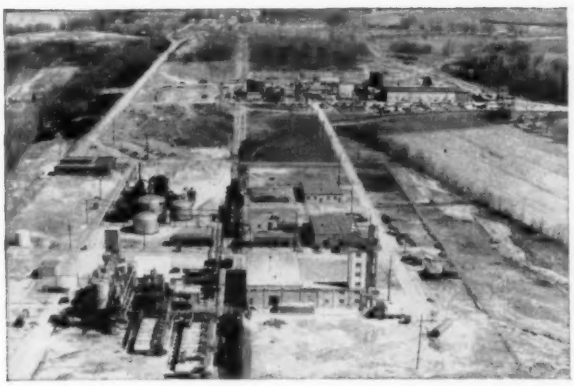

New Chemical Center Specifies CLAY PIPE for Sewerage System

CALVERT CITY, KY. recently installed 87,000 feet of Vitrified Clay Pipe as the initial project in the town's fast-growing sewerage system. In recent years, Calvert City has put itself on the industrial map by attracting a group of large chemical industries and establishing a new major chemical center. So far, $30 million has been invested in plants, with $9 million more committed for construction. Population has jumped from 400 to 1,000, and is expected to hit 10,000 within the next 10 years. When the need for a modern sewerage system became apparent, city officials realized that they had an opportunity to "do the job right" from the very beginning. Wisely, they specified Vitrified Clay Pipe.

Clay Pipe is *permanently* safe against chemical action. Time can't weaken it . . . countless years of service can't wear it out. Each section is *guaranteed for 50 years*—barrel, bell, and spigot. And that's your assurance that Clay Pipe sewers will be giving trouble-free service long after the financing bond issue is retired. It pays to specify Vitrified Clay Pipe—the *only* pipe that *never wears out.*

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Municipal Water and Sewer Commission:
Myron S. Pfeifer, T. W. Heilala, J. B. McLemore

CONSULTING ENGINEER:
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CONTRACTOR:
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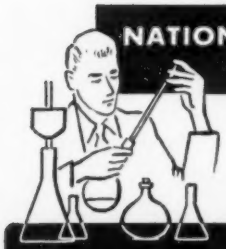

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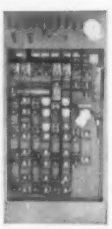

ROTO-TROLS for "CLOSED SYSTEMS" "BOOSTER SYSTEMS"— *Bulletin R-4*

The Type A ROTO-TROL is also furnished in cubicle mounting or for wall mounting for the automatic operation of several pumps either through straight sequence or through a programming action of the pumps to maintain given pressures in either a "Closed System" or to act as a Booster Pump Controller.

These units come equipped with synchronous motor time delay to give more positive timing and which is adjustable after installation over a wider period of time.

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chlorine did not inactivate it. There are, however, no data on two important factors in connection with the use of chlorine in this case. One is the clarity of the water after filtration and its organic content; the other is the type of chlorine residual.

Based on his own observations of experiments carried on during the war under his general direction, the editor believes: (1) That when water has been very well clarified, as by passage through a diatomite filter, a free chlorine residual of 0.5 ppm or a little more will inactivate the virus. (2) That lacking good clarification, the required chlorine dosage will be very much higher—perhaps 10 or 15 ppm. There is no proof for these beliefs; more work needs to be done to establish safe methods of treatment. Hepatitis can be an exceedingly important disease from the military standpoint. It is likely that it caused greater loss of manpower in World War II than any other disease excepting probably malaria.

Whenever possible, during the war, a sanitary engineer was sent to every epidemic area of infectious hepatitis to attempt to determine the importance of water as an agent of transmission. Unfortunately, the disease is of a nature (due to the considerable incubation period) that resists precise epidemiological investigation, especially during war time when military personnel are almost constantly on the move. As a result, no conclusive data could be assembled.

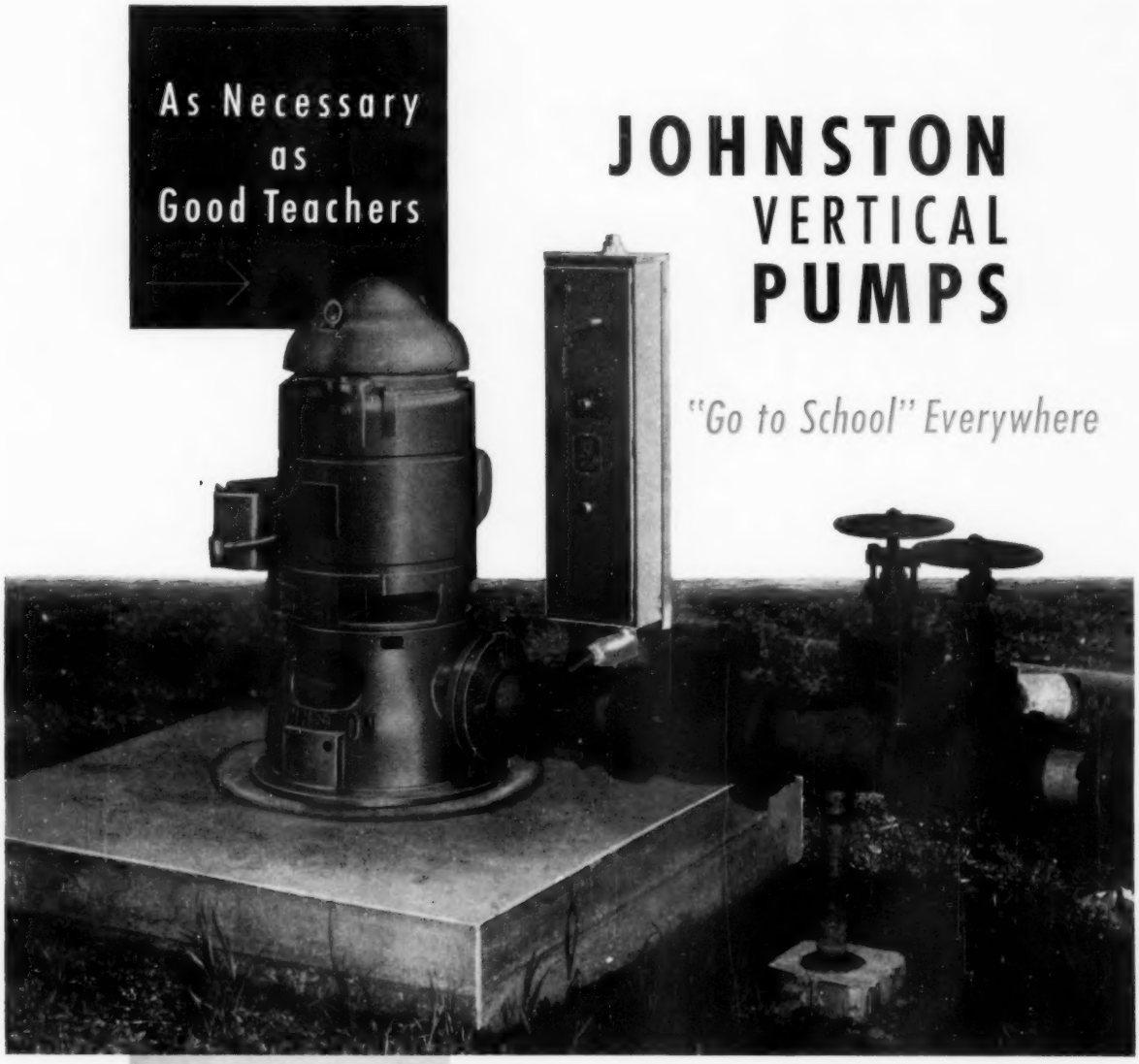
• • •

Traffic Increases in the Detroit Area

Each year since 1946, the Traffic and Safety Division of the Wayne County, Mich., Board of Road Commissioners has counted traffic on many major highways in the Detroit area. Counts made in 1955 showed that traffic in and out of the City of Detroit area increased 6.9 percent over the previous year, bringing the total increase since 1946 to 131 percent. Similar counts on out-county traffic showed a gain of 18.5 percent over 1954 and 217 percent over 1946.

Refuse Collection and Street Cleaning Costs in Toledo

Refuse collection in 1955 cost Toledo, O., $3.60 per capita, including costs of disposal. The cost of each stop for garbage and/or rubbish was 26 cents. Street cleaning cost $1.99 per capita.



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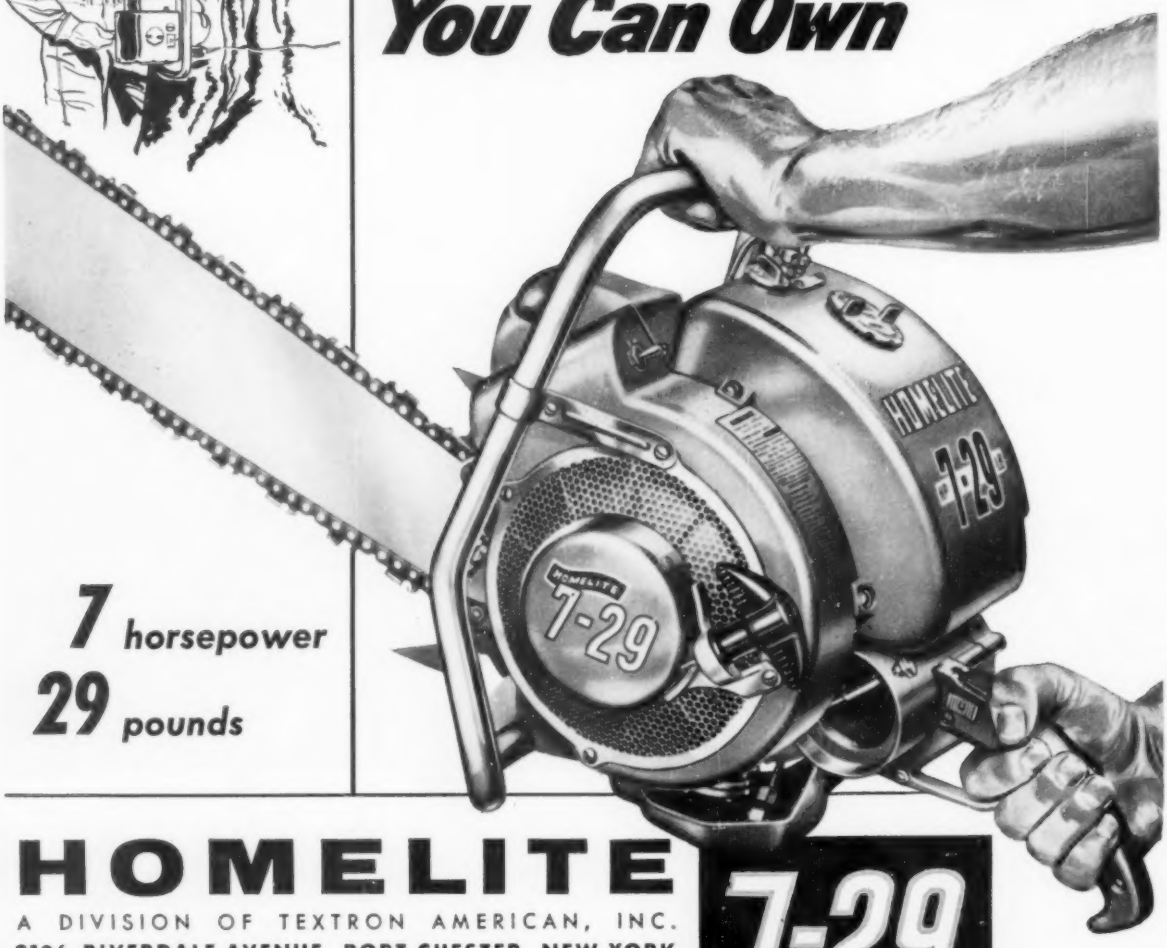

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● **INSTALLING a length of Armco fully coated and paved invert corrugated metal pipe. This new trunk storm sewer system has alleviated flooding in Coldwater, Ohio.**

How A Small City Installed Storm Water Drainage

R. K. CLARK,

Former Service Director, Coldwater, O.

Acting City Engineer, Middletown, O.

AMONG the many problems facing Coldwater, Ohio, a few years ago were the needs for storm drainage, for an elevated water tank, for more paved streets, for a hospital, for a school and for recreational facilities. With a population of only about 2500, it seemed like a large job to provide these needed improvements. Total cost was estimated at more than a million dollars.

What has been accomplished in the past seven years can well be illustrated by the approach to the drainage problem. To alleviate flooding that occurred during heavy rainfall periods in various parts of the community, a plan for a trunk sewer was developed and presented to the voters. This involved an initial expenditure of $75,000 and the program was approved by the voters. Several contracts were awarded in 1949 for the installation of storm sewers ranging in size from 18 to 72 inches in diameter. For these, Armco fully coated paved invert corrugated metal pipe, vitrified clay pipe and concrete pipe were used.

One of the special problems that arose was the crossing under the right-of-way of two railroads—the New York Central and the Nickel Plate. After considering, and taking bids on, alternate methods and materials, it was determined that jacking with corrugated metal pipe was most economical and satisfactory. This plan was approved by the engineering departments of both railroads. A total of 110 ft. of 42-in. corrugated metal pipe was jacked under the tracks by an Armco construction crew.

Eventually an additional $30,000 was appropriated for work necessary to complete the trunk storm sewer system. Additional work projects undertaken included improvements to the water works system. These cost $125,000 but reduced residential fire insurance rates 15 percent. In resurfacing old streets and building new streets, necessitated by new residential subdivisions, $133,000 were spent. Other improvements included a 50-bed hospital—a community, not a municipal project—and recreational facilities. These latter include a swimming pool 60 ft. by 90 ft.; a bathhouse; a lighted baseball diamond; four tennis courts with pay-meter lights; and a park with many provisions for the citizens.

Three mayors had a part in this improvement program—S. V. Moorman, Ralph A. Briner and the late A. H. Bernard.

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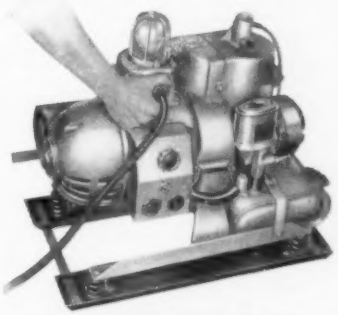

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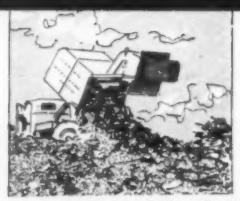

PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Strip Mine Used As Settling Tank

Du Quoin, Ill. built a treatment plant in 1937 which contained trickling filters, a digester and sludge drying beds. There was no final settling tank and by 1952 the decreased efficiency of the plant indicated that final settling should be added. This was provided by running the plant effluent into a worked-out strip mine area nearby, from which it overflowed into a creek. The area used was 2.5 acres, with an average water depth of 11 ft. This area also received the surface drainage from about 300 acres. The final effluent was very good, with a BOD of 5.7, until the winter of 1954, when a turnover of the deep pond brought foul matter to the surface; but a heavy rain soon after provided enough oxygen to cause the pond to recover quickly. In December of 1955 a turnover occurred and the effluent dissolved oxygen fell to zero. To remedy this, sodium nitrate was fed into the filter effluent at a rate calculated to satisfy about 25% of the total BOD added to the pond. In nine days the pond effluent had 3.0 ppm of dissolved oxygen and a BOD of 35 ppm. Feeding nitrates was discontinued a week later and no more trouble was experienced. It is calculated that about 332 pounds of BOD is being added to the pond per 24 hr., or 133 pounds of BOD per acre. It is believed that when the foul matter brought to the surface by the winter turnover becomes thoroughly mixed, dissolved oxygen can be maintained by feeding sodium nitrate for a short time only, and that this is necessary only during the first cold spell of the winter.

"Abandoned Strip Mine Cuts Used as Final Settling Units". By Eugene Jacoby, Supt. of Treatment Works. *Water & Sewage Works*, April.

Sludge Transportation Through Pipe Lines

Several cities in this country and abroad have been pumping sludge, both raw and digested, through pipes 8 to 12 in. in diameter and for distances up to 17 miles. Los Angeles, Calif. expects to pump digested sludge 7 to 8 miles and settled sludge 5 miles. Chicago is studying a plan to pump activated sludge 75 to 100 miles for disposal in abandoned strip mines. The digested sludges pumped in the above instances contain 4.0 to 10.0 ppm dry solids; the raw sludges contain 1.0 to 4.0 ppm dry solids. At Mogden, England, the friction loss in the pipe line is about 1.4 that for water. All of these have been operated successfully. In view of this, Cleveland, Ohio, is contemplating the pumping of the sludge from its sewage treatment plant and those of its satellite cities to a strip mine area about 100 miles away. Here a single strip mine trench is equal volumetrically to all the lagoons of the Chicago Sanitary Dist. which have been in use for 7 years. Acid-bearing runoff from these is a continuing source of pollution that could be partially stopped by the addition of highly alkaline digested sludge, and these huge wasted spaces could become in 15 or 20 years, a valuable asset rather than a liability to the owner. The

Planting Trees on Sanitary Landfill

● **CATERPILLAR No. 933 Traxcavator clears, excavates, spreads and compacts on the Havana, Ill. sanitary landfill. Site will be used for tree planting in future.**

PLANS HAVE BEEN MADE to put a twenty acre area of the sanitary landfill at Havana, Illinois, on a profit making basis. In addition, the project will bring a year-round Christmas atmosphere to the community.

The sanitary landfill method of garbage disposal was adopted by the city early in 1954. The area fill method is used and the landfill is operated seven days a week. Now completed fill areas will be planted with Christmas-type trees, a business like approach which is expected to pay for the original land purchase in a few short years.

Six private haulers, a city-contracted truck and numerous others use the site. Carriers come from a 10-mile radius, serving an estimated 7500 population. Refuse composition is 80 percent dry rubbish and the balance garbage, which, upon arrival is immediately covered. Approximately 40 tons is handled each week by a Caterpillar No. 933 Traxcavator, which also performs necessary land clearing and grading. The Traxcavator operator also drives a truck for daily refuse pickup in Havana and has salvaging rights.

An indirect advantage noted since adopting sanitary landfill has been a marked decrease in the amount of debris strewn along the highway.

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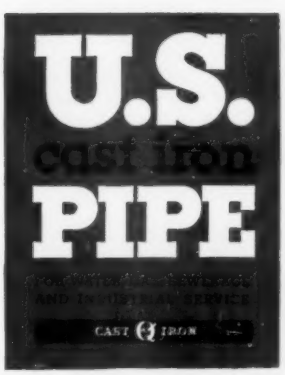

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Pittsburgh Consolidation Coal Co. has contracted to deliver by pipe line from the strip mines to Cleveland, a distance of 108 miles, more than 1,000,000 tons of coal a year. There are two booster pumping stations along the route of the coal force main. A proposed plan is described for building a sludge pipe line parallel to this coal force main, using the same pumping stations for both.

"Pipe Line Transportation and Disposal of Digested Sludge." By John J. Wirts, Supt., Easterly Sewage Treatment Plant, Cleveland. *Sewage & Industrial Wastes*, February.

Thickening Sewage Sludge

Tests of methods of thickening combined primary and trickling filter sludges were conducted at the 2 mgd sewage plant at Middleborough, Mass. Seven months of full-scale thickening operation confirmed that the principles of thickening can be successfully applied to sludges derived from other methods of treatment. During normal operation an average of 3,900 gal. of sludge was pumped to the digester per million gal. of raw sewage, compared with an average of only 1215 gal. of thickened sludge per million gallons of raw sewage during thickening operations. Inclusion of a sludge thickener tank in the treatment process improved the performance of the clarifiers because of the reduced supernatant load.

"Sewage Sludge Thickening Tests." By Sterling G. Brisbin, of Dorr-Oliver Corp. *Sewage & Industrial Wastes*, February.

Value of Sludge For Agricultural Use

In order to understand better the value of sewage sludge for agricultural use, additional study is needed on the following topics: 1. To what extent is the phosphorus in sewage sludges available to plant life? 2. Do the specific feeding powers of various plants differ with respect to their utilization of phosphorus in sewage sludges? 3. What chemical characteristics of sludges most effectively influence the rate of nitrification? 4. Biology of the trickling filter. 5. How is the high nitrogen content developed in activated sludges?

"Comparative Analyses of Sewage Sludges." By M. S. Anderson, Sr. Chemist, U. S. Dept. of Agriculture. *Sewage & Industrial Wastes*, February.

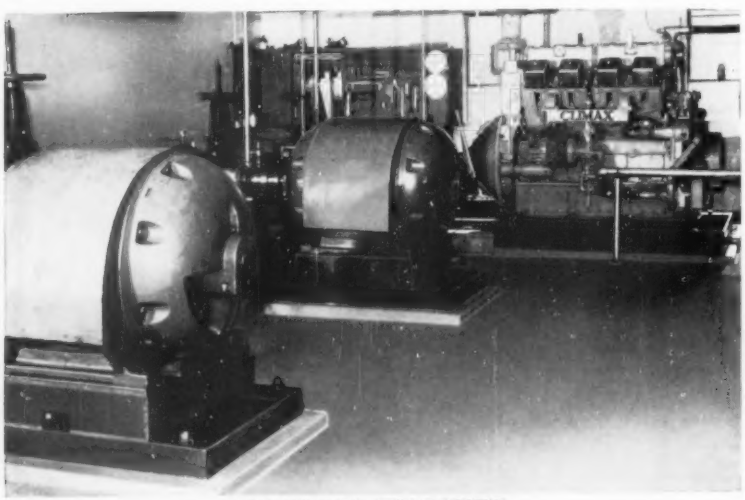
Test for Relative Stability

The "relative stability" of a sewage varies indirectly with the amount of organic matter and the number of bacteria, and directly with the concentration of nitrates. It is possible for one of these to be high without being reflected in the relative stability. By using sewage treatment plant data the author demonstrates the effect of dissolved oxygen on relative stability.

"The Relative Stability Test." By William L. Tidwell and J. H. Sorrels, of Texas Eng. Experiment Sta. *Sewage & Industrial Wastes*, February.

Theory of Sedimentation in Tanks

The author assumes the tank divided into an inlet zone, settling zone and outlet; preferably preceded by pre-flocculation in a tank which is constructed as an integral part of the settling tank. The wider the tank at the inlet, the more difficult it is to distribute the flow across the full width. The problem of introducing sewage into a tank centers about reduction of the inlet velocity. A tank with a sloped bottom reduces the tank volume by 25 to



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Pictured is one of the Climax model V-85 propane burning engines direct connected to a 700 GPM centrifugal pump requiring 192 H.P. at 1200 RPM.

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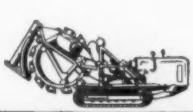
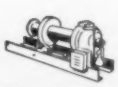


Gar Wood-Buckeye Ditchers



Gar Wood Winches

Gar Wood-Buckeye Spreaders

33% without reducing the surface area; the horizontal velocity approaches a uniform rate throughout the length, reducing short circuiting and eddies; the influent end of the tank provides the same mass of water to dissipate inlet velocity as does a conventional tank. The water depth at the inlet end should be twice that at the effluent. The length of the outlet weir or weirs should be as great as possible. Flocculating for 20 minutes before entrance into the inlet zone of the tank can increase the removal of suspended solids by 4 to 35%.

"Sedimentation Tanks". By R. W. Christy, of Link Belt Co. PUBLIC WORKS, May.

Advantages of Vacuum Filters

There are in operation upwards of 34 plants dewatering fresh sludge. Of these, 12 dewater primary sludge only; 3 dewater primary and activated sludge; 5, primary and trickling filter; 1, primary and garbage; 6, chemical precipitation; activated sludge only, 5. Fresh sludges are more amenable to dewatering than ripe sludges if a non-clogging filter medium is used. Savings in construction cost by providing for filtering fresh sludge may average $4 per capita of design population. Operation is not upset by heavy loading, temperature changes, etc.; manual handling of the sludge is avoided; less chemical dosages are required for conditioning fresh sludges than for ripe ones; odor nuisance from handling fresh sludge is eliminated by the lime used for conditioning. In contrast to drying on sand beds, vacuum filtration followed by disposal of the sludge by fill does not depend on weather or climatic conditions.

"Simplified Sludge Handling at Lower Cost". By Eugene H. Trubnick, of Komline-Sanderson Eng. Corp. PUBLIC WORKS, May.

Designing Sewage Pumping Stations

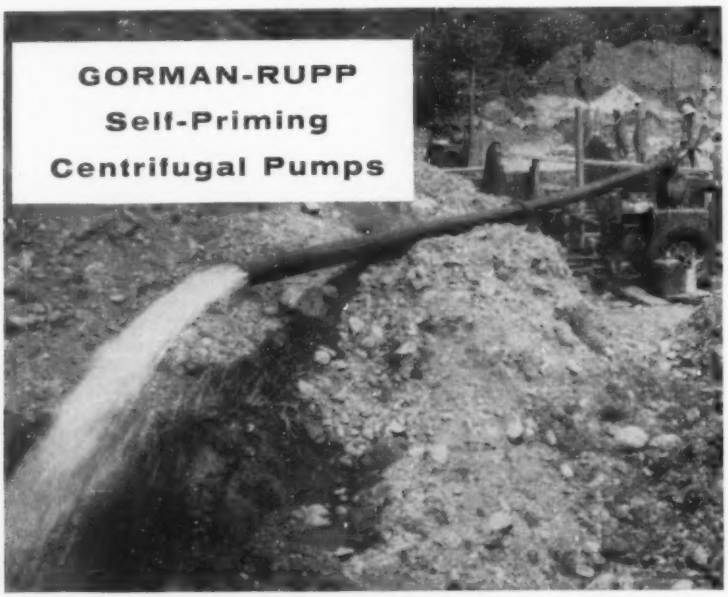
The author discusses in detail the principles of design; saying first that "a sewage pumping station should never be constructed where a safe, economical substitute will suffice." Among the principles given are the following: Despite their low efficiency, ejectors are desirable for small installations because little maintenance is required. Dry-well pumping stations are the most generally used type; they are practicable for both constant-speed and variable speed pumps; the former requiring considerable storage space. Among primary considerations are the location; rate of flow of the sewage to be pumped; the pump characteristics, choice between constant and variable speed and type of latter; and pump controls for automatic operation.

"Sewage Pumping Station Design Principles". By Raymond G. Martin, C. E. Associate, City of Los Angeles. *Sewage & Industrial Wastes*, February.

Counteraction Of Sewage Odors

Most chemicals that are known to be effective as powerful deodorants against air-borne odors are toxic to human beings in the concentrations required for odor destruction in the atmosphere. From the standpoint of odor, the worst gases are sulfides, mercaptans, indoles and amines; hydrogen sulfide is not always the primary problem. Combinations of these gases produce the typical sewage odor. Methods of controlling odors now available may be classified as combustion, absorption, odor

(*Continued on page* 150)



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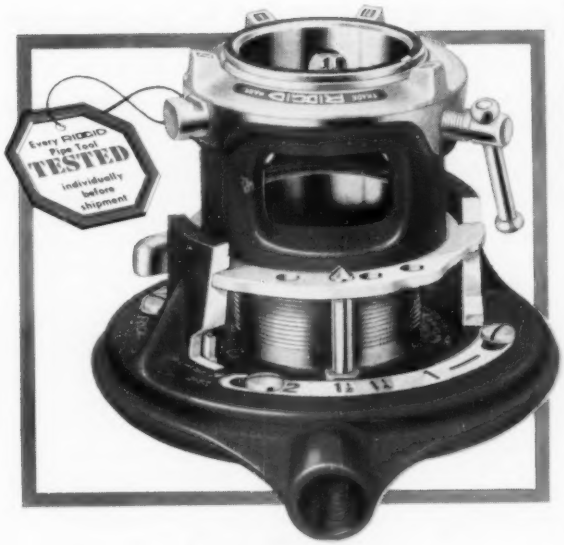

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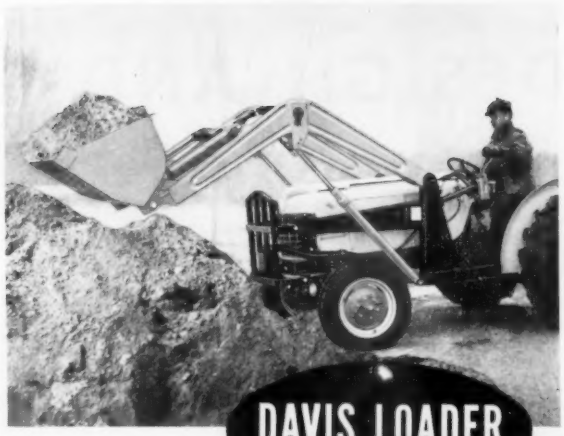

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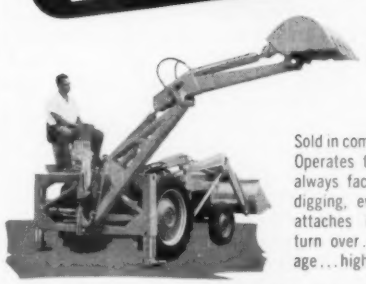

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DESIGN AND CONSTRUCTION of a 13-Mile Main Interceptor Sewer

FRANCIS A. OBERT,

Project Engineer,

Metcalf & Eddy, Boston, Mass.

This is a condensation of a talk by Mr. Obert at the Boston meeting of the American Concrete Pipe Assn.

SEWAGE AND industrial wastes have been problems in Rhode Island's Blackstone Valley since 1866, but actual construction to abate the problem did not begin until 1949. Completion is scheduled for 1957.

After the survey to determine conditions and needs came the problems of design. One of the first related to the size of the sewers. Considering that intercepting sewers are costly, that their installation inconveniences the public, that the larger their capacity the lower the construction cost per unit of capacity, and that the annual rate of depreciation is low, it was determined to design for a 50-year period in the future.

The main interceptor sewer follows roughly the course of the Blackstone River to Bucklin Point in East Providence. This will be about 7 miles long, with the largest diameter 90 ins. An interceptor in the Moshassuck Valley will be 3 miles long with a maximum diameter of 48 ins. A third line in East Providence, from Pawtucket to Bucklin Point, will be 2 miles long, also with a largest diameter of 48 ins. The work involves ten crossings of the Seekonk, Moshassuck or Blackstone Rivers; 5 tunnels with lengths up to 5,000 ft.; four railroad crossings in tunnels; several complicated diversion structures; and the problems accompanying open-cut trenches in busy streets. Total construction cost will be about $6,200,000. In all, there are about 69,000 ft. of sewer, of which 55,000 will be precast concrete, with diameters from 15 to 60 ins. Trench depths vary from 2 ft. to 30 ft.

Earth and Rock Tunnels — The problems involved in tunnel work, whether it be an earth or rock tunnel, or combination of both, are complicated. The longest tunnel now under construction will be about 5,000 ft. in length and at its deepest point will have about 135 ft. of cover. The excavation is mostly solid rock. The tunnel has two changes in direction and all work is being accomplished from one portal. There are no shafts along the line for excavation purposes.

The contract requires that a manhole be constructed at each change in direction. These manholes will be about 75 ft. deep and the inside diameter will be 48 in. It is expected that the lower 55 ft. will be concrete poured in place against rock and that the upper 20 ft. will be precast concrete pipe. No manhole steps are required.

After the tunnel is completed, a 48-in. diameter pipe will be laid and jointed. The inside surface of the pipe will be coated with Prufcoat or equal. The space between the pipe and the tunnel walls will be filled with a mixture of sand and stone.

Seekonk River Crossing — The crossing of the Seekonk River, a navigable tidal stream, was accomplished with little difficulty. This crossing consists of a battery of three pipe lines in a common trench, a 16-in. cast-iron pipe (Usiflex), a 48-in. and a 30-in. concrete pipe. The concrete pipe was specially designed for underwater construction. The trench excavation at its deepest point was about 35 ft. below the mean high water line. All work was done from a lighter and two barges. The lighter carried the equipment required to drill and blast rock and to excavate, while the barges supported and carried the trucks and excavated materials. The rock was drilled from above the surface of the water with long drills. In some instances casings were driven into the trench above the rock and extended to a little above the water surface. The dynamite was then placed in the drilled hole by lowering it through the casing. After blasting, a specially designed bucket was used to excavate the material from the river bed.

Three pipe lines were installed in order to carry the present sewage flows and those estimated for the future. The 16-in. and 30-in. lines are presently carrying the daily sewage and diluting stormwater from about 600 acres in Pawtucket, an area with a population density of about 25 persons per acre. The low flows are confined to the 16-in. pipe by means of a weir in the inlet chamber. The 48-in. pipe line has been sealed off with a brick bulkhead which will be removed when the sewered area is extended and the sewage flow increases. Ultimately, the crossing will serve an estimated population of 56,000 persons in an area of 2,600 acres with a population density of 22 persons per acre.

The Seekonk crossing was about 700 ft. long of which 200 ft. was at maximum depth. The total cost of construction including the inlet and outlet structures, was $410,000 or about $600 per foot.

Concrete Pipe—Most of the contracts specified precast concrete pipe with rubber gasket joints. The last five contracts require centrifugally spun pipe, ASTM Specification C76 Table II. For the river crossings, where concrete pipe is required, we have specified concrete pressure pipe utilizing joints made with rubber gaskets in concrete collars, or approved equal. Centrifugally cast concrete pipe with rubber gaskets has been selected because of its density and durability, the reduction in the number of joints due to long lengths of pipes, the water tightness, as evidenced by relatively small volumes of infiltration, and the possibility that the pipe can be jointed in a wet trench and may be backfilled immediately.

We have specified the concrete collared pipe for the river crossings because the flexibility of this joint allows depressed sewers, in most cases, to be laid without using bevelled-end pipe or special fittings. Also, these joints have proved to be unusually watertight on other projects constructed under our supervision.

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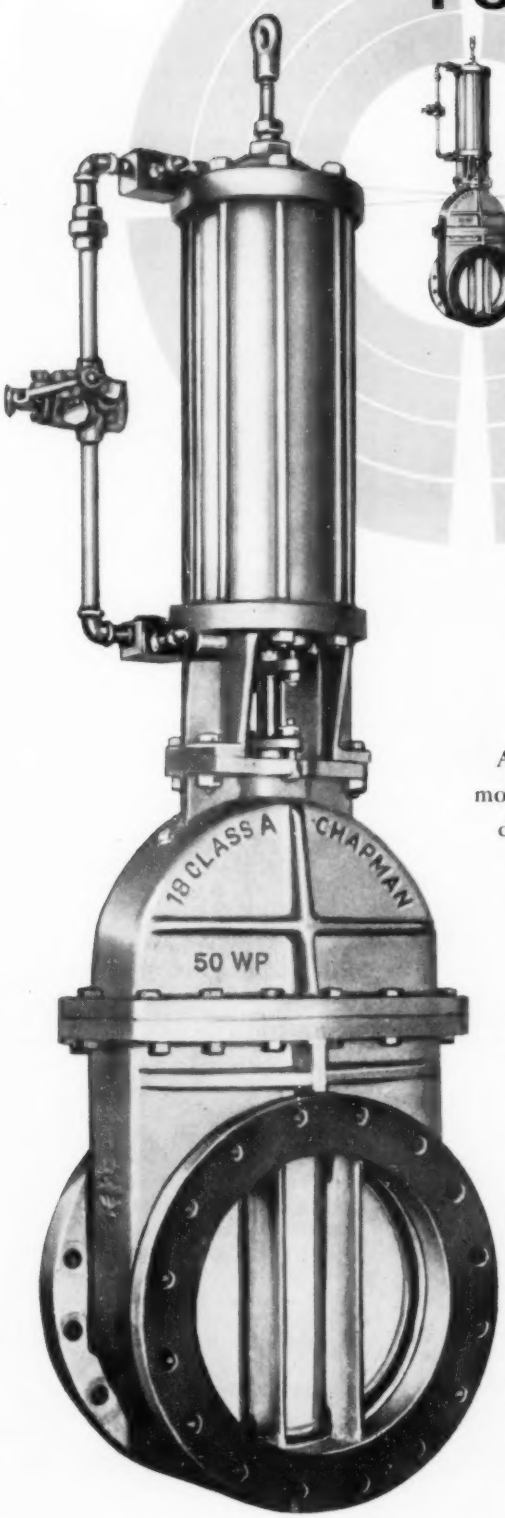

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Sewerage and Refuse Digest

(*Continued from page* 146)
modification, and counteraction. The author discusses couteraction. A Flemist scientist about 1900 discovered that two substances, odorous singly, may be inodorous when combined, as cedar wood vs. rubber. In using counteractants, these are vaporized into odorous atmosphere. by use of compressed air.

"Counteraction of Sewage Odors." By Nicholas Post, of Airkem, Inc. *Sewage & Industrial Wastes*, Feb-

Other Articles

"Performance of a New Type **Mechanical Aerator**", the Cavitator. By K. L. Schulze, of C. E. Dept., Michigan State Univ. Sewage & Industrial Wastes, February.

"**Winston-Salem** Sewer Expansion Program". By P. D. Davis, of Piatt & Davis. Sewage & Industrial Wastes, February.

"Effects of High Concentrations of Nitrogen on **Activated Sludge**". By Robert L. Taylor, San Francisco Operations Office; Everett R. Mathews, Santa Operations Office; and C. W. Christenson, Los Alamos Sci. Laboratory. Sewage & Industrial Wastes, February.

"**Slime Formation** in Sewage: Nature and Composition of Slimes". By H. Heukelekian and E. S. Crosby, of Rutgers Univ. Sewage & Industrial Wastes, February.

"**Stage Construction** Matches Sewage Treatment to Subdivision Growth". Describes several instances in Florida. By John W. Wakefield, of State Bd. of Health. Public Works, May.

"**Opportunities** (for young engineers) in the Field of Sewerage". By Arthur H. Niles, Comm'r. of Sewage Disp., Toledo, O. Public Works, May.

"**Opportunities** for Engineers in State Health Departments". By Blucher A. Poole, of Indiana State Bd. of Health. Public Works, May.

"**Trickling Filters** in Series Give Good Treatment" of settled sewage, without intermediate sedimentation. Public Works, May.

"Developments in **Radioactive Waste** Disposal". From report of Atomic Energy Com'n. for Jan., 1956. Public Works, May.

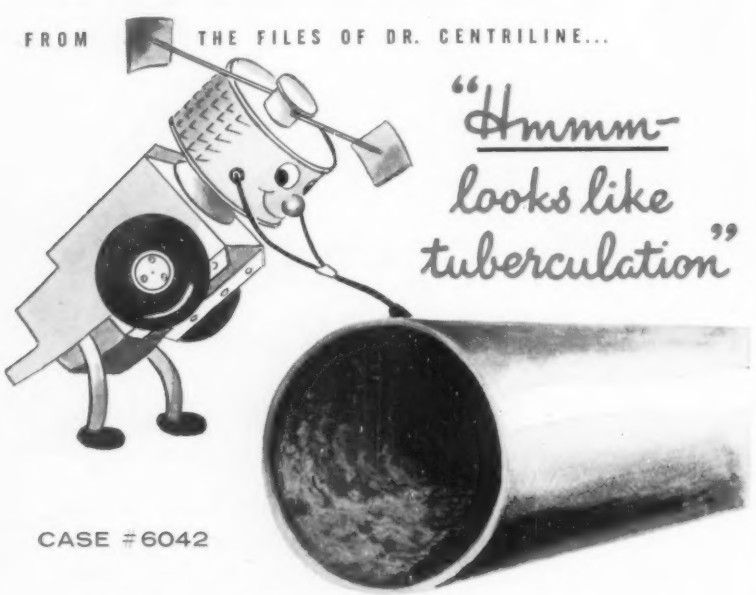
"Requirements for Establishing **Industrial Waste Ordinance**", regulating discharge into sewers. By Dean M. Taylor, Sr. San. Eng'r., Cincinnati, O. Water & Sewage Works, April.

"The **Biological Assessment of Pollution** in Birmingham (England) Streams". A general discussion by H. A. Hawkes, Biologist, Birmingham, Tame & Rea District Drainage Board. The Surveyor, April 7.

• • •

Disaster Preparedness Plan Is Adopted

Two cities have adopted plans for disaster preparedness, Birmingham, Mich., and Kenosha, Wisc., according to Public Management. Primary responsibility for disaster control is assigned to the city government with provision for coordination with other governmental and private agencies. The plans of both cities designate the officials who may place the plans in effect and establish control centers. The Birmingham plan specifies that the control center have complete telephone and radio communications and maps and records of all streets, water and sewer lines, and public buildings within the city. The Kenosha plan outlines the basic responsibilities of the disaster organization in several types of disasters; including civil defense, storms, train wrecks, epidemics, floods, utility failures, heavy snowfall, airplane crashes, major fires, strike violence, food shortage, and mob riots.



PATIENT: 36 miles of twin 20" Cast Iron supply lines, Portsmouth, Virginia.

SYMPTOMS: Insufficient water in Portsmouth.

DIAGNOSIS: Low pipeline capacity caused by flow restricting tuberculation.

TREATMENT: The twin 20" mains were cleaned and cement lined in place without interruption of water supply service to Portsmouth. The Centriline Process of centrifugally applying cement mortar was used.

RESULTS: Each pipeline is now capable of permanently carrying twice as much water as prior to cleaning and lining.

Examine your own capacity, corrosion and leakage problems to determine the value of the Centriline treatment to you. Cleaning and cement lining in place has been the successful remedy for almost 1,000 miles of water supply pipelines.

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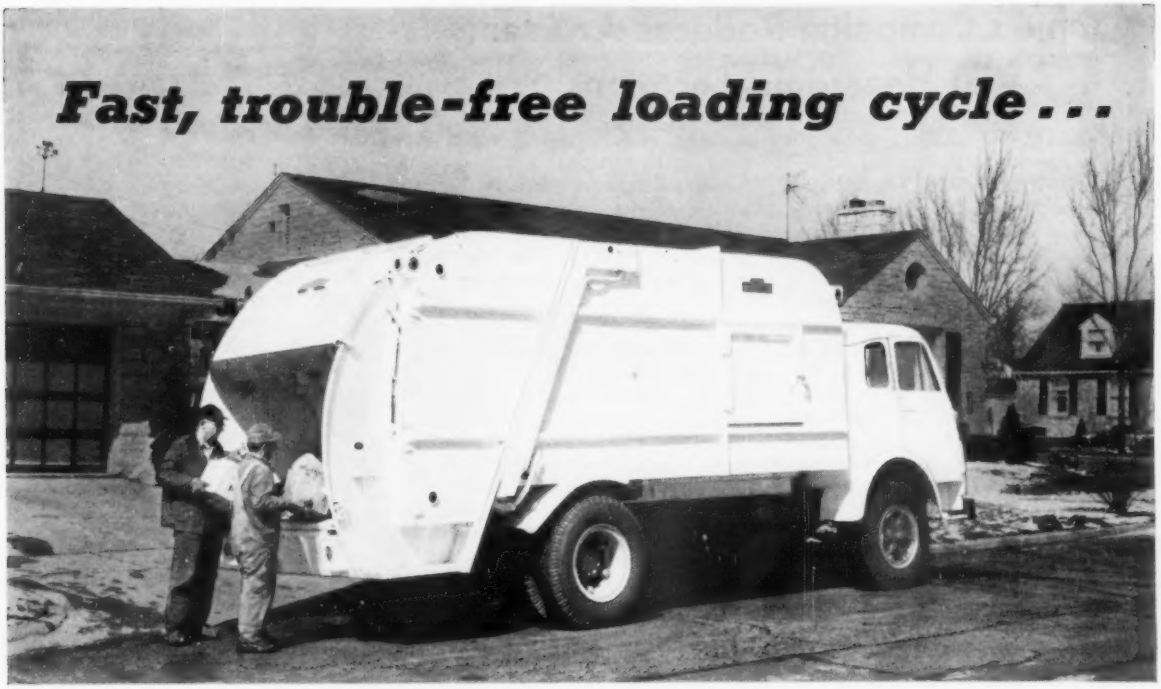

with HEIL Colectomatic

Finger-tip Control. Here's timesaving simplicity — the touch of a lever starts the completely automatic loading and packing cycle. Two hydraulic tailgate cylinders close the safety door, raise the hopper, sweep out the load and begin packing action. In just 23 trouble-free seconds, the safety door opens for the next load.

Horizontal-Thrust Packing Action. The packing plate is located high in the hopper to provide better leverage . . . exerts a stronger packing action against the load through horizontal thrust. This packs a maximum amount of refuse into the body, reduces the number of unloading trips, assures better collection service.

Simplified Operation. By reducing the number of operating parts, the Heil Colectomatic eliminates trouble. There are no chains for refuse to jam in . . . only two hydraulic cylinders control entire work cycle, a third controls body dump. Should refuse jam between packing plate and floor of hopper, a push of a stoppage control lever drops hinged hopper and loading cycle begins again in seconds. It all adds up to lower maintenance, more money saved for the taxpayer. BH-61

OTHER COLECTOMATIC FEATURES TO SIMPLIFY REFUSE COLLECTION

- **Quiet Operation**
  No clanking chains, minimum truck engine acceleration when loading.
- **Comfortable Loading**
  Low, wide sill allows two men to load hopper side by side.
- **Simplified Servicing**
  All lube points can be reached through panel door on each side of body.
- **Fast Dumping**
  Flat floor, obstruction-free tapered body provide fast, clean dumping. Load distribution on axles provides good stability while dumping.
- **Safety**
  Load-packing mechanism is completely enclosed. Safety door protects personnel from flying debris.
- **Compact Body**
  Allows better maneuvering when loading in narrow, restricted areas.

Get a demonstration from your Heil distributor and see the fast, trouble-free operation of a Colectomatic.

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Ohio's Campaign Reduces Accidents at Hazardous Locations

RECOGNIZING THE challenge for providing faster, safer travel on Ohio's highways, the Ohio Highway Department's Division of Operations is actively working to reduce accidents. The Division's efforts are now being directed to the improvement of forty of Ohio's accident-prone locations.

Selecting forty locations which had usually high accident frequency, the Bureau of Traffic made careful studies of causative factors and prepared necessary corrective measures. After a year, analysis of accidents at these locations, showed an impressive overall reduction of 65 percent. In seven locations, all accidents were eliminated during the one-year period; at seven others accidents were reduced 90 percent; and at nine others, reductions in excess of 60 percent resulted.

The Bureau tried to determine why one bad intersection would differ from a similar area with a lower accident rate. Detailed traffic and engineering studies followed, and the engineers were successful in isolating many of the major causes. By the application of well-established techniques, many of the hazardous features were then eliminated.

Illustrative Example

At one major location, a subway on State Route US 25 in Butler County, the engineers were faced with improvement of an abrupt curve that had a record of 20 accidents within one year. North of Cincinnati, the two-lane section of Rt. 25 descends on a 5 percent grade for ¼ mile and runs beneath a railroad. Immediately beyond, the highway makes an abrupt turn and continues up another hill; 20 mph speed limit signs were posted at intervals along both approaches. South bound motorists, having traveled at a high speed previously, ignored the speed limit signs on the five-percent downgrade. Unable to see because of the overpass, drivers failed to make the turn and either collided with a vehicle coming in the other direction or crashed through the guard rail. During rainy periods, traffic from both directions, ignoring the apparently unreal speed limit, went off the road because of the slippery pavement.

Careful study of the location and the nature of the accidents that happened there showed that many procedures would be needed to reduce the excessive number of accidents. At first, 80-inch long reflectorized arrows were installed, facing both directions. Since cars were going downhill in both directions, the angle of the headlamps was too low to light up the signs in time; so flashing signals and direct illumination were added.

The Bureau eliminated the low speed limit signs and installed 20 mph warning signs in their place. All unnecessary signs, route markers, and confusing warnings were removed. At the beginning of each approach to the curve, delineators—small reflectorized posts—were installed every 100 feet. As the distance from the curve was shortened, the interval between markers was shortened to 16 feet on centers. The delineators were continued on around the curve, psychologically forcing the driver to turn.

The pavement was replaced with a non-skid type, and no-passing lines were added. Bridge-end markers were installed on the abutments of the underpass. The first year after the improvements were completed, the accident rate was reduced from 20 to 5, or 75 percent.

The accident rate at the 40 locations which had a total of 589 accidents prior to improvements, has been lowered so that, for the one-year period following, only 207 accidents were reported. Assuming that the prevention of 382 accidents can be attributed to the correction of the physical features of the locations, the Bureau of Traffic plans further studies looking toward highway accident reduction.

Clayton Billings Joins Editorial Staff

Clayton Billings joined the editorial staff of PUBLIC WORKS on June 1. A long-time member of the Bureau of Sanitary Engineering of the Texas State Board of Health, he has had broad experience in the current important problems of water procurement and treatment, sewerage and industrial waste and in the training of personnel. For several years he has been responsible for planning and directing the program of the Texas Water and Sewage Short School—one of the largest and most successful meetings of its kind; and he has also edited the valuable operators' manuals published by the school.

Clayton H. Billings

Born in Grand Rapids, Michigan, he became a Texan when his father, L. C. Billings, was appointed Superintendent of Water Purification for Dallas in 1930. He was graduated from the University of Texas; and immediately after graduation was employed by the Texas State Department of Health, with which he has been ever since.

We welcome him to PUBLIC WORKS where he will have the fullest opportunity to make this magazine ever greater in value, usefulness and service to the public works industry.

• • •

Radio Used by Detroit Water Department

There are now 28 cars and trucks in use by the Detroit Water Department which have radio equipment. During the past fiscal year, radio equipment was installed on two hydrant installation and three hydrant maintenance trucks as well as on the Hydrant Division Foreman's car.

GOING IN...

...a long-term community investment

It's Transite Ring-Tite Pressure Pipe

• Transite® Ring-Tite® Pressure Pipe is a community investment that pays off year after year!

Its remarkably high flow characteristics protect that investment by keeping maintenance and pumping costs at a minimum during its long service life.

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Transite Pipe is strong, durable, and highly resistant to corrosion. And it is immune to tuberculation, the form of interior corrosion that chokes the flow and increases pumping costs. Transite cannot tuberculate, thus its original high flow capacity is maintained, and pumping costs are kept at a minimum year after year.

The Ring-Tite Coupling, with rubber rings compressed and locked in place forms a joint that is tight yet flexible. Rings cannot blow out, and the automatic separation of the pipes within the coupling helps to relieve line stresses.

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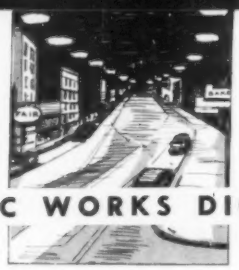


PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Night Legibility Of Highway Signs

In 1955 the Highway Transport Research Branch of the BPR conducted some studies to determine the effect that spacing letters of words, used in highway signs, had on their nighttime legibility. More than 2,500 observations were made by 36 observers while driving an automobile at 30 miles per hour. White reflectorized letters, 10 inches high, were displayed on a black nonreflectorized background. Three different alphabets were used. Two of these, the standard Series C with narrow letters and the wider Series E, were cut from reflective sheeting. The third alphabet, identified as Series ED and similar in width to the Series E, was designed by a manufacturer using 1¼ inch-diameter plastic reflectors to form the letters. The spacings between letters were increased as the lengths of the six test words were extended from normal to 20, 40, and 60 percent above normal.

As interletter spacing was increased, the legibility distances also increased for all three alphabets until word lengths were 40 percent above normal. The resulting gain in legibility at this point was 15 percent for Series C, 16 percent for Series E, and 7 percent for Series ED. Beyond the 40-percent increase in word length, legibility leveled off or declined.

When word lengths were normal or no more than 10 percent above normal, test signs with the Series ED alphabet were found to have greater legibility. At wider spacings, the Series E alphabet was superior.

As might be expected, the 10-inch Series E alphabet was legible at a greater distance (118 to 142 feet) than the narrower 10-inch Series C alphabet at corresponding letter spacings. On a percentage basis, the differences in legibility favoring the Series E alphabet ranged from 23 percent to 27 percent. A word with letters of the Series C alphabet is shorter in length than one with letters of the Series E for a given spacing, and a comparison of legibility distance per inch of word length showed that the Series C alphabet was somewhat superior to the Series E. Also studied was the probable effect of increasing the letter height of the narrower alphabet until the legend area equaled that of the wider alphabet. At the point of equivalent legend area and spacing, the two alphabets proved to be equally legible.

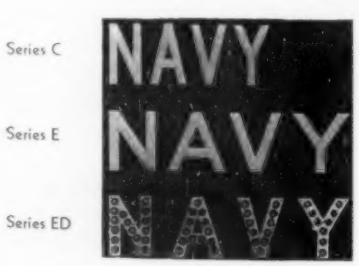
The study findings point to the importance of sign proportions and provide an improved means for efficient determination of legend design. Where vertical dimensions restrict sign letter heights to something less than desirable, increased spacing between letters can help to compensate for the loss of legibility distance that would otherwise occur.

"Effect of Letter Width and Spacing on Night Legibility of Highway Signs." By David Solomon, H'way Transport Research Eng'r. *Public Roads*, April.

Sawed Joints In Concrete Pavements

Either diamond blades or reinforced silicon carbide discs are used for sawing joints. The latter permit earlier sawing of green concrete and have a longer life in sawing green concrete than for sawing older pavement. Prices for sawing per linear foot range from 3 to 83 cents. The highest item is blade cost. A 12 by ⅛ inch diamond blade costs about $150; its life ranges from 400 to 6,000 linear feet. A silicon carbide disc costs from $5 to $18. Some states find that where the concrete aggregates are relatively hard, sawing costs about twice as much as forming joints; in other cases the cost of the two methods has been about equal. In some cases a 1-in. depth of cut in an 8 or 9-in. slab has been found sufficient, in others it was not; but 1½ in. seems to be sufficient in all cases for both transverse and longitudinal joints. It is possible that the depth should increase with the size of coarse aggregate particles. A variety of sawing equipment is available. There are manually pushed saws with single blades, and self-propelled saws having one or several blades in tandem.

"Sawed Joints in Portland Cement Concrete Pavements; Progress and Problems". By Edwin J. Coppage, Jr, Chf. Construction Management Section, B.P.R. *Public Roads*, April.



Courtesy Public Roads

● **COMPARISON of Series C, E and ED alphabets at normal spacing.**

Florida's Highway Testing Laboratory

A new $250,000 laboratory has been constructed by the Florida State Road Dept. at Gainesville. There are physical, chemical, soil and bituminous laboratories, where are tested cement and concrete aggregates, and reinforcing steel; paints; creosote; guard rails; bituminous materials and mixtures; limerock for base; soils; and timber. When a concrete pavement has been completed, a core drill is used to determine the thickness of the pavement.

"A Modern State Highway Testing Laboratory." By C. E. Wright. PUBLIC WORKS, May.

Constructing Cement Treated Bases

A California contractor who specializes in this class of work describes late improvements in methods for increasing economy. The most important item is coordination. Equipment details include spray bars on mixers, leveling

"NEVER THINK ABOUT TROUBLE WITH THE CAT* NO. 112"

—W. F. Corley, Mayor, City of Clute, Texas

Six days a week and 12 months a year, this Caterpillar No. 112 Motor Grader is busy cleaning ditches, spreading shell and maintaining streets in City of Clute, Texas.

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1. Easy operation. The 75 HP Caterpillar Engine is simple and dependable, requiring a minimum of maintenance. Sure, in-seat starting, fast, accurate blade positioning without leaving the cab, positive controls and full visibility of the job from the seat are advantages operators like.

2. Dependability. Every Caterpillar Motor Grader is completely built—not assembled—by one responsible manufacturer. It's ruggedly constructed to do its job day after day and year after year.

3. Economy. Because these machines are built to give more years of trouble-free service, with less down time, you can figure on lower depreciation, greater resale value. They operate on low-cost, non-premium fuel without fouling. And now *tubeless tires* eliminate costly tube and flap trouble and can reduce tire down time by as much as 80%.

Let your Caterpillar Dealer show you other money-saving, work-boosting features of these big yellow machines. His reliable service and parts facilities back their long, economical life. Take a lesson from contractors who find it pays to standardize on Caterpillar equipment. Get a demonstration today.

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screeds, water wagons behind the mixers and a reverse plow on the cement distributor. To prevent delay of any piece of equipment, have the rock spread out far ahead of the mixer, the day's requirement of cement spread as far as possible ahead—usually beginning 2 or 3 hours each day before starting mixing. Have enough compacting equipment behind the mixers so that they can operate before the material dries out.

"How Surge Principle Helps Step Up the Cement Treatment Job". By Harold G. Buttles. *Roads and Streets*, April.

Air Blasting Fertilizer on Roadsides

Where large amounts of fertilizer, seed and mulch are to be distributed over road shoulders or side slopes, distributing by hand is very expensive and time consuming, and many states and counties have adopted mechanical distribution from a truck by either hydraulic or pneumatic equipment. The latter, using equipment similar to a sand blaster, does not require water and is generally preferable. Blasting finely pulverized fertilizer is difficult, but a fertilizer in the form of hard grains about the size of small pebbles has recently been placed on the market which makes air blasting of fertilizer practicable. Maryland uses a sand blasting equipment designed for cleaning granite, stucco, etc; two units travel in tandem, one firing high and far, the other low and close. By using high analysis 12-12-12 fertilizer, one dose suffices for two years for roadside grass. On the West Virginia turnpike, 12-12-12 and seed are combined and pumped hydraulically through a nozzle.

"Better, Quicker Turf With Nozzle-Fed Pelleted Fertilizer." By Peter C. Crollus, of Allied Chemical and Dye Corp. *Roads and Streets*, April.

Seeding Roadsides On Kansas Highways

Soon after contractors have finished grading operations on federal and state highways in Kansas, shoulders and slope areas are seeded to grasses and legumes. Contracts are let separately for practically all of the seeding and mulching. During 1955, fifteen seeding contractors covered 326.3 miles of highway, an area of 5,100 acres being seeded and 526 acres mulched. This cost an average of $37.83 per acre for seeding and fertilizing and $145 per acre for straw mulch to stabilize slopes. These low costs are attributed to the use of farm type drills, discs and cultipackers; the ability to get stands of grass using lower rates of fertilizer than many states find practical; and availability of wheat straw or old prairie hay from local sources.

"Protecting Highways With Roadside Vegetation". By Franklin T. Rose, Landscape architect, State H'way Com'm. PUBLIC WORKS, May.

Other Articles

"**Bitumen Emulsion** in Road Construction." Methods of manufacturing, selecting and applying. By L. G. Wootton Dir. of Steve's Emulsions, Municipal Engineering, March 16.

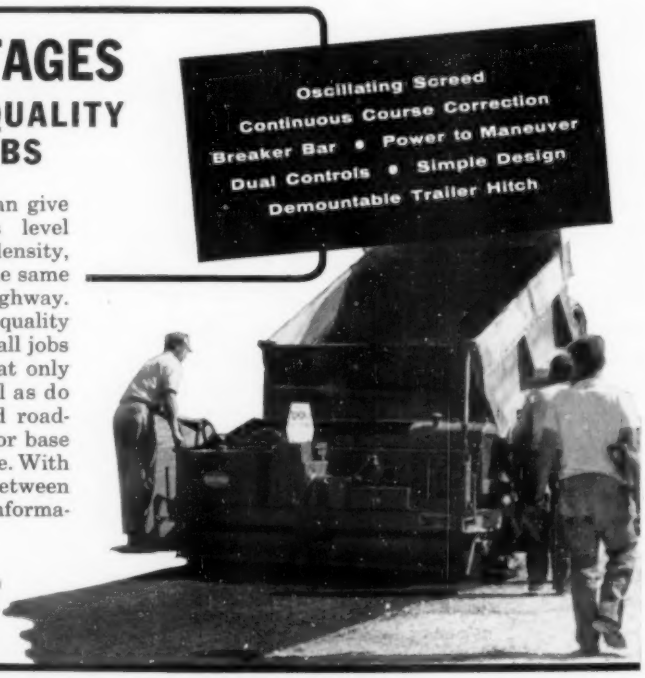
"**Low-Cost** Dust-Free Roads" in Ottawa Co., Mich.; bituminous surface on 7 in. of gravel base with 12 in. sand sub-base and drainage. By Henrik E. Stafseth, Eng'r Mg'r. Public Works, May.

"Highway **Estimating Methods:** General Overhead Costs." By George E. Deatherage. Roads and Streets, April.

"**Slurry Seal** for Street and Highway Surfaces". By Fritz Zapf, City Eng'r., Monrovia, Calif. Public Works, May.

ADNUN JR. ADVANTAGES
GIVE SUPER HIGHWAY QUALITY TO SMALL PAVING JOBS

● Here's a tow-type black top paver that can give you tight longitudinal joints, continuous level courses of even thickness and improved density, so every bituminous paving job will have the same high quality as a rigidly specified superhighway. With a Blaw-Knox Adnun Jr. to give this quality paving, you can economically pave such small jobs as driveways, parking lots, garage floors that only a small compact paver can handle, as well as do some specification jobs such as streets and roadways. The Adnun Jr. will also spread rock for base course as well as hot or cold asphaltic concrete. With its own power, the Adnun Jr. can maneuver between courses to save truck time. For complete information see your Blaw-Knox Distributor.



Adnun Jr. lays smooth, even finish course on filling station parking lot.

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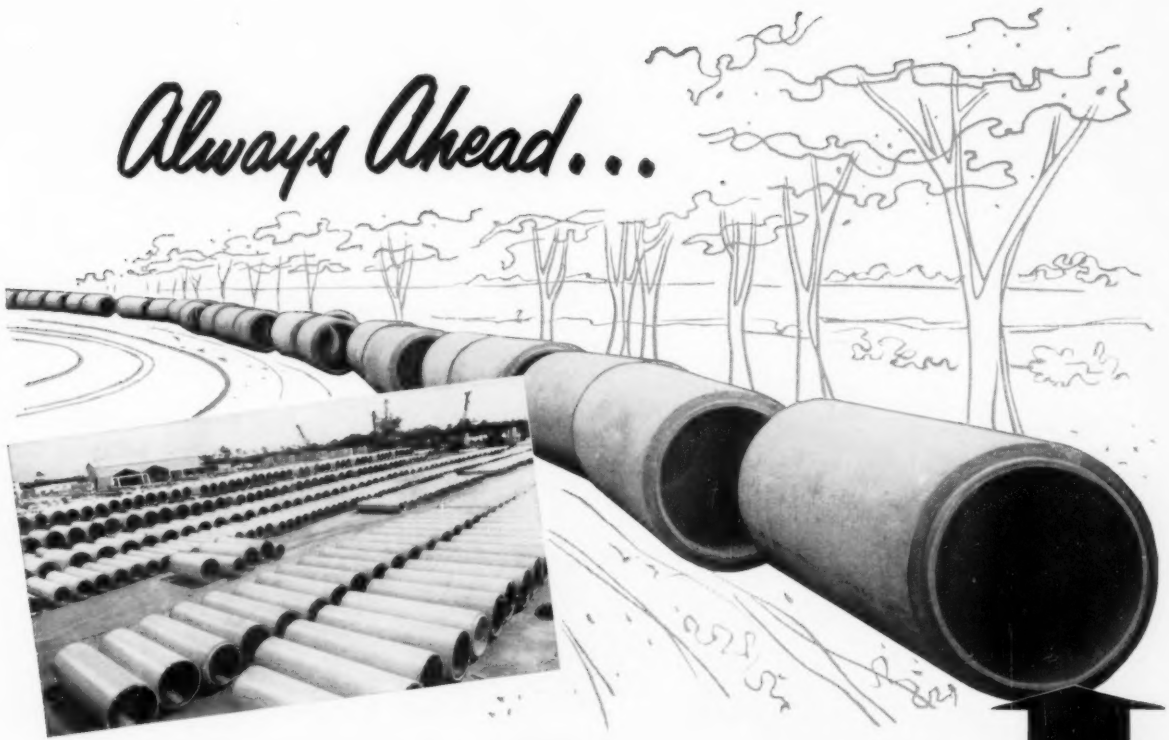

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These long lengths are always ahead of the job—because American-Marietta Company's many up-to-date facilities, strategically located throughout the country, assure prompt and regular deliveries. Long lengths speed installation, too, by reducing handling and joint making. Built-in smoothness of *unquestioned permanence* provides sustained high flow capacity—cuts operation and maintenance costs.

"Pressure proven" rubber and steel AMSEAL Joints are flexible to permit normal expansion, contraction, deflection and settlement—yet they provide a positive, water-tight seal against costly infiltration or leakage.

Be sure to specify long length concrete pipe with AMSEAL Joints for water intakes, sewage outfalls, inverted siphons, intercepting sewers, circulating systems and low pressure sewer and water mains.

Our technical staff will be pleased to assist you with your pipe problems.

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Sensational NEW THERMO-COMPOUND For Traffic Line Marking. 500% MORE EFFICIENT!

PERMA-LINE is the only answer to every traffic marking problem: Long Life . . . Rapid Drying . . . Keeps Traffic Flowing . . . Cuts Maintenance Costs . . . Easiest, Quickest Application. PERMA-LINE can save your municipality as much as 40% in traffic stripe costs.

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Get full details of this month's products . . . mail your Reader's Service card today.

MUNICIPAL AND STATE SELF-INSURANCE

THE IDEA of self-insurance for cities and states has occurred to most officials of political units of government, and many cities and states now have funds for insurance of government property. Three years ago the National Association of Insurance Agents published information on the subject, and most city and state officials have been approached in this regard. A booklet issued by the association has an introduction which begins as follows:

"Proposals for governmental self-insurance are invariably made with the idea of saving money by not paying insurance premiums. However, there has never been an instance where a governmental unit has reduced taxes by not purchasing insurance. Rather, the record is sprinkled with cases where heavy additional assessments have been levied on taxpayers because of uninsured losses to governmental property.

"Inherent in the possession of any form of property is risk, which can be defined simply as the chance of loss. The term risk is also used by insurance men to mean the concrete thing that is subject to the risk, such as a building . . . . Where the perils of fire, windstorms, etc., are involved, it is impossible to rely on logic in any specific case. In order to measure a risk a great mass of statistical data must be collected. In a simple instance such as the tossing of a coin in a wager, risk can be measured as a percentage. The chance of loss is one-half or 50 percent. Inasmuch as a coin can fall only in two ways, and only one way can cause a loss, it is obvious that the chance of this coin falling adversely is one out of two.

"To determine the chance of loss by fire to a municipal building, it is necessary to gather statistics as to how many fires occurred during a given period in a wide area and how many similar buildings were exposed to the peril of fire during that period. For instance, if it can be determined that out of 10,000 similar buildings throughout the country, ten have burned, then the chance of loss can be mathematically calculated to be 1/1000 or 0.1 percent."

It is true that any state that has kept a similar record may come to a similar conclusion as to percent-

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NO WEEDS!

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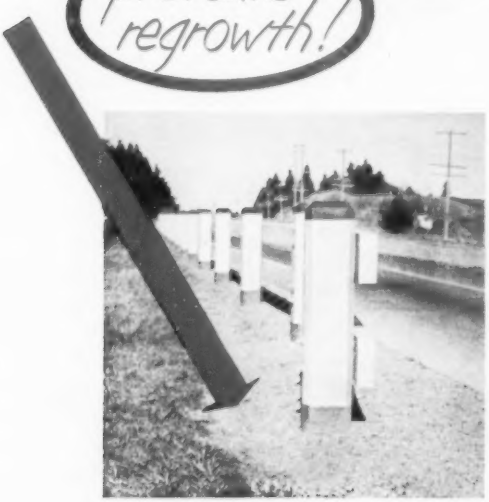
WEED and GRASS KILLER

kills weeds—

prevents regrowth!



One application—DRY—may keep soil bare for 1 or 2 years!

Here's new UREABOR . . . a ready-to-use weed killing compound so powerful that only 1 to 2 lbs. can destroy most types of vegetation in an area of 100 square feet! And control continues effective for long periods because UREABOR *maintains its plant-destroying activity in root zones.* Such low application rates mean greater convenience . . . less storage space for material. You'll say it's great!

Because of its granular form, UREABOR Weed Killer is easily broadcast by hand for spot treatments. Larger areas are more efficiently treated by using a mechanical spreader. For most effective distribution of the small amount of material required, we created an inexpensive, handy spreader especially for UREABOR Weed Killer.

Special Spreader now available...

The PCB Spreader applies UREABOR to best advantage, at prescribed low rates. It holds enough UREABOR to treat 1250 to 2500 sq. ft. without refilling—weighs a mere 6 lbs. Available now for just $10.75 delivered—anywhere in the U.S.A.

Write today for literature!

LOW RATE OF APPLICATION—
EFFECTIVELY DESTROYS WEEDS AND GRASSES
NOTHING TO MIX—NO WATER TO HAUL
NONCORROSIVE • NONFLAMMABLE

**UREABOR is a trade-mark of Borax Consolidated, Limited*

AGRICULTURAL SALES DIVISION

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

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MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS ®

Thousands use our Readers' Service card to keep up to date . . . do you?

Four-wheel drive, and tires 2' wide, give Tournatractor ample traction to make full use of its 208 hp.

Here's what high-speed on rubber can do for you

Tournatractor, with 17 mph forward speed and 8 mph reverse speed, can do many tractor jobs twice as fast as a crawler-tractor.

Drives anywhere

Because of its big low-pressure tires, Tournatractor drives anywhere under its own power. Job-to-job moves can be made across pavement, over curbs, sidewalks, and railroad tracks. On long moves it saves time, bother, and expense of locating a trailer, moving in extra manpower and transport equipment, loading and unloading.

Reduces maintenance

Tournatractor greatly reduces maintenance and service costs by eliminating some 500 wearing parts that grind through dirt in a crawler-track assembly. Eliminated also is the friction caused by grit-grinding in the track assembly which reduces effective working horsepower.

Easy to operate

With simple easy-to-handle power controls, and comfortable, adjustable, foam-rubber seat, operator on Tournatractor works comfortably, with less fatigue, maneuvers faster, gets more work done, in less time, with less effort.

High-speed performance

Constant-mesh transmission eliminates delays in changing gears . . . saves vital momentum . . . gives any gear-ratio instantly. As a pusher or dozer, Tournatractor high-speed reverse (up to 8 mph) is a very important time saver.

Versatility helps get more work done

Wide range of attachments increase Tournatractor range of applications, extend length of work season. Find out for yourself how high-speed C Tournatractor can take over a major percentage of your tractor work, and save you money. Ask for owner-verified job reports on work similar to yours.

Tournatractor—Trademark Reg. U.S. Pat. Off. T-954-G-z

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

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age of loss, but it is doubtful if a correct result can be estimated, and the premium for self insurance by states can be determined, except that the total loss in a given period might be rather exorbitant for self-insurance for a state as against average losses all over the country, when insured in a fire insurance company.

Wisconsin has had an insurance fund for a number of years, under which insurance is offered for a term of one, three and five years, for governmental units in the state. This insurance covers loss by fire and lightning, fire and extended coverage, wind and hail, builders' risks, floaters and all risk insurance on movable property. The fund also provides motor vehicle insurance for fire, theft, wind or comprehensive coverage.

Insurance by the state of Wisconsin is offered under the following rates and conditions: Counties, cities, villages, towns, school districts and library boards may insure their property in the State Insurance Fund as provided in Section 210.04 of the Wisconsin Statutes by having their board pass a resolution authorizing such insurance and thereupon filing a copy of the resolution with the Fund. After voting to insure in the Fund, the board in authority would be prohibited from purchasing the same type of insurance in other companies. Existing policies with other companies at the time of the passage of the resolution are permitted to run to expiration.

The Fund is a subscriber of the Fire Insurance Rating Bureau and the insurance written is computed at the rate established by this Bureau. The premium is then discounted 50 per cent, thus effecting a saving of 50 per cent over companies using the same rates without deviation. Coinsurance clause is optional.

It is optional to insure personal property such as school buses, motor vehicles, highway or road equipment and other personal properties in other companies, providing that this option has been stated in the resolution and property identified.

Wisconsin states further: If you vote to insure in the Fund and can give us the description of the property, size, age, approximate cost and condition, we will help you in arriving at the present insurable value. Later, a representative of the Fund may call and personally inspect and appraise the property. We do not send representatives to meet with the various authorities before

said authorities vote to insure in the Fund.

"Any insured may withdraw from the Fund by passing a resolution rescinding the original resolution and filing it with the Fund. State Fund policies in force upon passage of the rescinding resolution terminating insurance in the State Fund may be left to run to expiration or cancelled short rate at the discretion of board in authority.

"The State Insurance Fund cannot provide: Unemployment or Workmen's Compensation insurance; public liability and any type of casualty insurance."

BOOKS IN BRIEF

TILT-UP CONSTRUCTION

Tilt-up precast concrete construction has become a standard method of construction on the Pacific Coast. This book is the fourth edition of an already well-known treatise on the subject. There are 100 pages, offset, with illustrations both hand-drawn and photographic; there is also a lot of valuable information on methods of doing the work, from casting surfaces and molds to the final erection; also data on costs. The text can be obtained from F. Thomas Collins & Associates, Box 208, San Gabriel, Calif. The price is $12.50.

THE MOVING WATERS

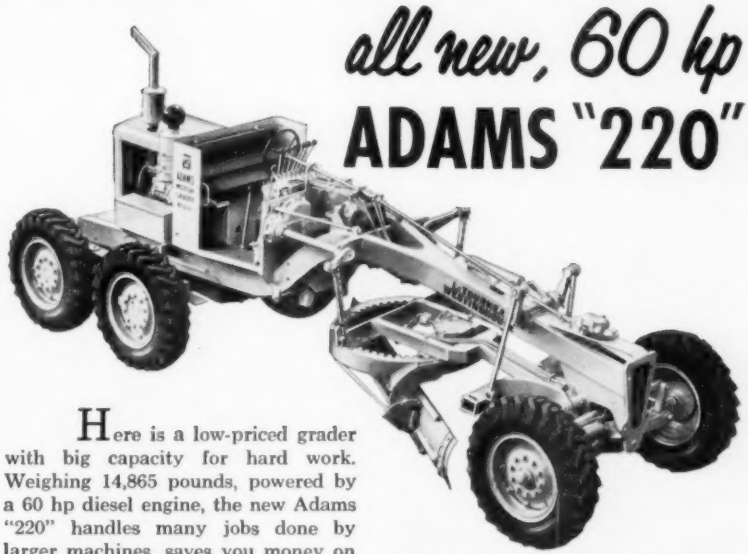
This report reveals the complexities involved in the pulp and paper industry's pollution abatement problem and provides material which could be used in local public relations programs devised to inform the public, various regulatory bodies, and other interested groups as to the paper and paperboard industry's role in the pollution abatement field. Bulletin 54. Request copies from National Council for Stream Improvement, 271 Madison Ave., New York 16, N. Y.

ASPHALT CONSTITUENTS AND EFFECTS OF CHLORINATION AND MICRO-ORGANISMS

This bulletin contains three papers entitled: 1. "Effect of Chlorination on Oxidizability of Road Asphalts;" 2. "Constitution and Characteristics of Paving Asphalts;" 3. "Action of Microorganisms on Petroleum-Asphalt Fractions." Copies are available from the Highway Research Board of the National Academy of Sciences, National Research Council, 2101 Constitution, Washington, D. C. Price 90¢.

Today's big news in graders...

all new, 60 hp
ADAMS "220"



Here is a low-priced grader with big capacity for hard work. Weighing 14,865 pounds, powered by a 60 hp diesel engine, the new Adams "220" handles many jobs done by larger machines, saves you money on general grading and road maintenance. Big in value, the Adams "220" out-works, out-maneuvers any grader in its size and price class.

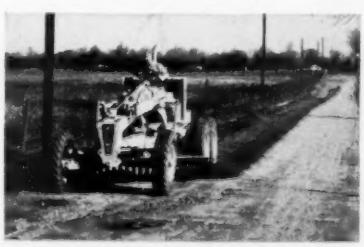
Works like a big machine

Like the larger Adams machines, the "220" has 4 working speeds under 6.5 mph, and 4 optional "creeper" speeds for full use of engine power in slow, rugged, or precise work. Travels job-to-job up to 18.3 mph.

Blade controls are straight-line-thrust hydraulic. Moldboard swings from ditch-cut to 90° high bank cut on either side of grader, in less than a minute, without operator leaving cab. 10-ft. slide-shift moldboard has 6 pitch positions, and reaches 54½" outside wheels. Leaning front wheels, hydraulically operated, offset side thrust, make short turns possible. Wide tread (76" front, 77" rear) gives stability, safety, and easy handling on slopes.

Built like a big machine

"220's" big 10:00 x 24 tires on all six wheels give firm footing and minimum rolling resistance. Sturdy 4-wheel tandem-drive utilizes full engine power, provides push-power and traction for doing many of the heavier jobs. Rugged diesel engine is cranked electrically, starts quickly in all seasons. Optional cab has 6'4" inside height, floor to ceiling, without use of "foot wells".



Four work speeds, 1.8 to 6.4 mph, provide best combination of power and speed for every grading assignment.

Sturdy one-piece, rectangular-welded-section frame, and strong Y-shape drawbar, withstand punishing shocks and stresses. Arched frame provides 17" blade clearance to clear shoulders when climbing out of ditch.

Anti-friction steering, and smooth, fast-acting hydraulic brakes give operator confidence to work or travel at highest practical speed.

Scarifier, power-shift moldboard, 12' blades, cab are optional.

See Adams in action

We will be glad to prove to you that "220" as well as larger Adams graders work harder, faster, and at lower cost than other graders of similar size and power. Why not call or write and ask for a competitive demonstration?

Model 220.... 60 hp....14,865 lbs.
Model 330.... 80 hp....20,500 lbs.
Model 440....104 hp....21,500 lbs.
Model 550....123 hp....23,500 lbs.
Model 660....150 hp....27,730 lbs.

AG-44-G-z

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Peoria, Illinois
A Subsidiary of Westinghouse Air Brake Company

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"OUR SHERMAN POWER DIGGER is the most economical machine our city owns," says one city manager. For digging bell-holes alone, it has cut costs in half. They also use their Sherman for road and street repair and maintenance, water line taps, service lines and the hundreds of other digging jobs that daily confront city engineers.

Here are a few of the reasons why Shermans are used by so many cities and municipalities: Fast operating cycle, high visibility around other utility lines and easy maneuverability in constricted areas.

See this productive unit in action at your local Ford Tractor dealer TODAY, or write for Bulletin No. 544.

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PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.

Now's the time to mail this month's Readers' Service card.

A MODERN TRAFFIC SIGN SHOP

A STATE SIGN shop which ranks among the largest and most efficient in the nation is now in operation at the Wellesley Maintenance and Traffic Depot, a new $3 million headquarters for the Massachusetts Department of Public Works. Because of the life-saving role assigned to traffic signs, the Massachusetts Department of Public Works is producing about 50,000 signs each year. The production of this large volume of signs had resulted in outgrowing the old sign shop facilities, previously located in downtown Boston.

Besides a traffic sign shop, the depot also houses facilities for vehicle maintenance and repair and a materials testing laboratory. It is designed to help fulfill the requirements of the current three-year highway expansion program—a $200 million program to modernize existing roads and build new roads to meet the demands of present and future traffic volumes.

The traffic sign—the on-the-spot communication device by which the highway engineer reaches the motorist—has increased steadily in importance with the mounting traffic volume. Several years ago, Massachusetts highway authorities initiated an extensive program of sign modernization. Massachusetts signs were made larger to give the motorist longer reading and reaction time. Since at 60 miles per hour a vehicle is moving 88 feet per second and the average driver requires 55 feet merely to get his foot to the brake, and another 171 feet to stop, large signs, visible and readable at greater distances, are needed to give the driver the extra time he needs to react.

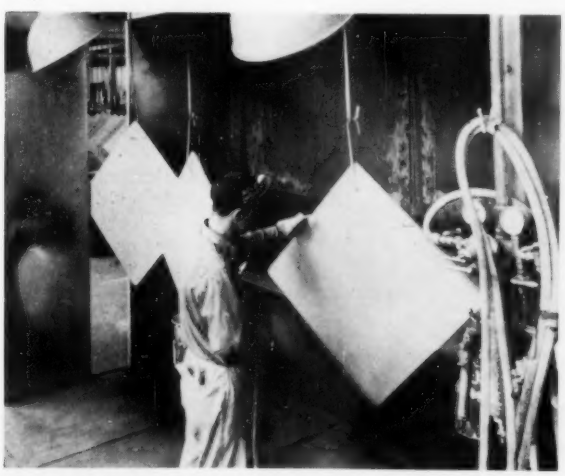
● **SPACIOUS working area permits utmost efficiency in the making of road signs.**

A program of nearly 100 percent reflectorization of state traffic signs and markers was initiated to give the nighttime motorists the same rapid communication provided the daytime motorist. About one-third of the nation's driving is done at night, but more than one-half the yearly highway fatalities occur after dark.

A study to determine the effectiveness of the Massachusetts reflectorization program showed that, in spite of traffic volume increases since the program had been initiated, nighttime traffic accidents were 23.3 percent less.

The sign shop occupies 12,300 square feet of floor space which is divided into two rooms—a preparation room where wood and steel sign backings are given preservative treatment, and a finishing room where sign messages or symbols are applied. Overhead monorails are provided to carry the signs through to the finishing room.

Preparation of steel blanks involves spraying with zinc chromate primer and finishing coats; wood backing requires three coats of enamel; aluminum blanks require only cleaning and etching. Both wood and steel sign blanks are painted in a spray booth equipped with a ventilating capacity of 16,000 cubic feet of air per minute.



● **SIGN backing is sprayed in the spray booth. The sign blanks enter and leave by overhead monorail carrier.**

● **SIGN message is often silk-screened on the reflective sign face when a large number of the same type is produced.**

In the finishing room, the sign is completed by adding the message in paint or reflective materials. Of the Commonwealth's signs, 80 percent are surfaces with reflective sheeting. This sheeting is applied by squeeze-roll applicator or vacuum applicator, depending upon the quantity and size of the desired sign.

The squeeze-roll applicator is used for long runs of a particular sign. Sign blanks are fed by hand into the applicator, and trimmed as they come out. The applicator automatically removes the paper liner on the back of the reflective sheeting; coats a solvent on the adhesive to activate it; and bonds the sheeting, under pressure, to the blank.

The vacuum applicator operation, used for short runs and larger signs, involves placing the reflective sheeting on the sign blank, and inserting it into the applicator which removes the air, then allows heat to activate the adhesive on the sheeting.

The sign message or symbol is applied by silk-screen process, when many of the same type of sign are to be produced, or by adhering cut-out letters of non-reflective "Scotchcal" plastic film.

Aluminum Extensions Mount Fluorescent Luminaires

WHEN THE City of Fairmont, West Virginia, decided to modernize the lighting on its High Level Bridge, it was found that twenty of 37 concrete pedestals, an integral part of the bridge, had to be utilized in the modernization plan. These pedestals were about eight feet too short for the new lighting system and provided no practical means of support for the fluorescent lighting fixture.

Aluminum extensions, with castings to fit the size and contour of the pedestal tops, were designed by engineers of Hubbard Aluminum Products Company. Set bolts tighten the casting to the concrete standard. With these extensions, the overall height of the concrete standards was increased from 21 to nearly 29 feet, and each one provides support for a new 400-watt fluorescent fixture.

The installation was recently completed by Monongahela Power Company, which has maintained the bridge lights since 1936. Originally, the 37 pedestals had been equipped with 200-watt incandescent lamps. The 20 new fixtures have an output of 440,000 lumens, compared with 118,325 lumens provided by the 37 original lamps.

The fixtures feature an adjustable mounting bracket that may be tilted from 20 to 30 degrees to direct light more efficiently. The lamps are designed to avoid change in light output from —30° to +80°F.

Installation of the new system marks the first phase of a five-year relighting program planned by Fairmont city officials. Similar fixtures will be used in relighting the main business district and the Watson and Bellview bridges.

How a fast, compact TENNANT Sweeper... City of Winston-Salem (N.C.) sweeps downtown walks with their Tennant "75" Sweeper.

sets a new standard in clean, LOW-COST sweeping

In busy downtown areas, where *clean* sweeping counts most, but is costly—a compact TENNANT POWER Sweeper pays for itself fast. It not only *does the work of a crew of men;* it sets a new standard for clean work. You'll see the difference.

Sweeping easily around parked cars, its powerful brush-and-vacuum system rapidly cleans a 48" path. Picks up dust, dirt, paper, sand—the usual loose light litter found in gutters, on walks and in alleys. Does a remarkable job.

It's rugged...compact...easy to use; and superbly engineered for long, dependable service.

Write today for details.

SPECIAL FEATURES

- Sweeps 4 to 8 times faster than by hand.
- Sweeps EXTRA CLEAN; has vacuum dust control.
- Dumps load mechanically.
- Cleans 48" path; can sweep flush with walls, curbs.
- Reverses instantly.
- Steers easily in traffic; has 38" wheelbase.
- Can also be used in PARKING LOTS, RAMPS, GARAGES, etc.

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SPECIALIZED MAINTENANCE EQUIPMENT

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...Before Ordinary Equipment Could Be Set Up!

To unplug sewers in "lakes" like this, just roll the SEWERODER up to the manhole — drop in Rod Guide, direct it into sewer pipe — and start the machine.

This mechanical robot rods — rotates and retracts — with no delay for connecting rods by hand.

SEWERODER's super speed enables your crew to clean many more sewers in the same emergency period — saves many a basement from flooding — reduces danger of contaminated water supply — and all at lower cost per foot.

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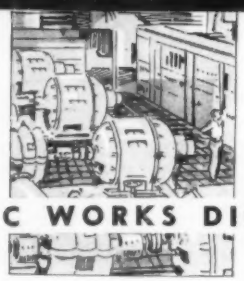


PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Corrosion of Various Metals

This article describes tests made made of the corrosive effects of several waters on aluminum, brasses, phosphor bronze, copper, galvanized iron, black iron, lead, monel, stainless steel, tin and zinc. The six waters used in the tests were the public supplies of several California cities. A soft, colored well water of low mineral content and free of dissolved oxygen, but containing some hydrogen sulfide, was less corrosive to most of the metals than were the other five waters. The same water, treated so as to be free of color and hydrogen sulfide but containing some dissolved oxygen and a chlorine residual, was appreciably more corrosive than before treatment. A moderately soft water of low mineral content was distinctly more corrosive to aluminum than the other waters. A naturally hard river water, saturated with oxygen, with a relatively high dissolved solids content and resultant high conductivity, was particularly aggressive, both before and after treatment, to type 410 stainless steel and to the anodic members of most galvanic couples. After having been softened, filtered and chlorinated, this water became markedly more corrosive to black iron and 410 stainless steel.

"Effects of Water Quality on Various Metals". By Lee Streicher, Chief Chem., Met. Water Dist. of So. Calif. *Jour. AWW Ass'n*, March.

Snail and Clam Infestation of Water Supplies

Certain mollusks are known to cause troublesome conditions in potable water supplies, such as reduced pressure, tastes and odors, and presence in faucet water. The author describes several experiences which have been reported in the literature, and suggests methods of preventing entry, and of eliminating these from infested mains. Prevention can be accomplished by chemical coagulation and filtration; or by locating the intake in deep water away from shoal areas; or by removing from shallow water plant growths that snails might feed on. Mollusks in the pipes can be killed by introducing chlorine or certain copper compounds, but tastes and odors will invariably result from their decay. A sure method would seem to be physical removal of the shells by a pipe scraping device.

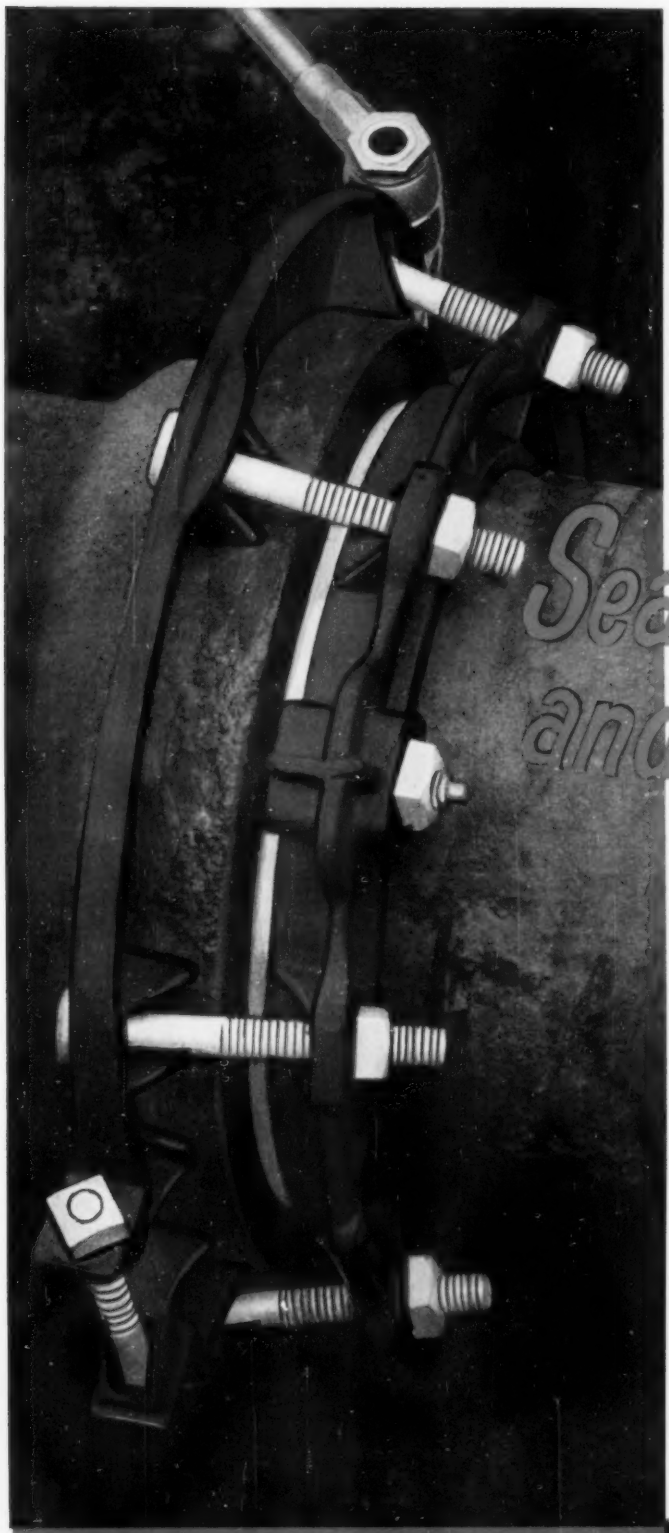
"Snail and Clam Infestations of Drinking Water Supplies". By William Marcus Ingram, biologist, Robert A. Taft, San. Eng. Center. *Jour. AWW Ass'n*, March.

Copepoda in Water Supplies

Indianapolis experienced an infestation of Copepoda (small crustaceans) in 1953 and again in 1954, and an investigation was made by the water company to learn how to prevent their pressure in the system. They conclude that **Copepoda** infestations are related to stored supplies which have conditions and environment favorable to their reproduction. The adults are easily killed by chlorination with available free chlorine residuals of 10 ppm and sufficient time of contact. Infestations in purified water result when many individual eggs pass the filters and hatch in the distribution system. Copepoda growth in the distribution system can be eliminated by proper copper-chlorine-ammonia application. Worms, water fleas, rotifera and possibly nematoda can also be eliminated by such treatment, the effectiveness of which depends partly on the cleanliness of the distribution system. It cannot be as effective when dead ends contain chlorine-

Water Line Construction Speeded With a Back Hoe

A major improvement to the Brazil, Indiana, water supply system is 20 miles of a new 8-inch cast iron pipe water main and new 8-inch to 12-inch cast iron distribution lines. A heavy-duty ¾ yd. Lorain 26 back hoe dug the trenches for the new lines through heavy clay and used a 40-inch dipper. However, in the downtown section, a 30-inch top-width trench was specified. The back hoe also handled and placed the pipe. Trenches were dug 5 ft. deep, to provide an average of 3½ to 4 feet of cover over the pipe and an average of 1000 lineal feet of pipe was laid per day. The contractor was Chas. F. McCurdy of Cincinnati, Ohio.



THE CLAMP WITH THE *Sealed Gasket and 3/4" Bolts!*

SKINNER-SEAL Bell Joint Clamps stop bell and spigot joint leaks under pressure. Speedy one-man installation cuts repair costs.

Gasket is completely SEALED and protected; at the bell face by a Monel Metal Seal Band; at the spigot by hard, vulcanized gasket tip, acting as a plug. Equalized pressure forces gasket into every crevice in the joint, sealing the leak at its source. Sturdy malleable iron Compression and Anchor Rings—shaped and pressure-tested before shipping. Large 3/4" bolts. Plated or unplated. Malleable iron bolts furnished on special request.

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SKINNER-SEAL BELL JOINT CLAMP

"Lowest Price and Highest Quality are seldom found in the same product."

Golden-Anderson concentrates on high quality —the surest way to lowest cost in the long run. That's why G-A Valves do the job they were designed for—accurately . . . dependably . . . constantly, and with minimum maintenance.

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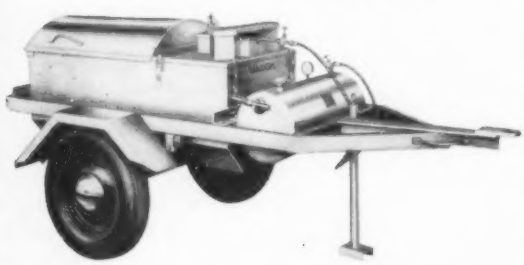

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New Advanced Design

Hauck fire box steel firing tube and heavy duty heating tube system. • Improved chassis frame for faster, easier mobility. • Faster melting and draw-off of material. • Comfort, convenience, cleaning and protection features. Sizes—55, 80, 115, 165,230 and 330 gallon capacities. Burn kerosene or bottled gas.

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demanding material which, when utilized, frees the copper to precipitate as the carbonate.

"Biologic Infestation at Indianapolis". By M. P. Crabill, Mgr. of Operations. *Jour. AWW Ass'n*, March.

Backfilling Trenches in El Cajon

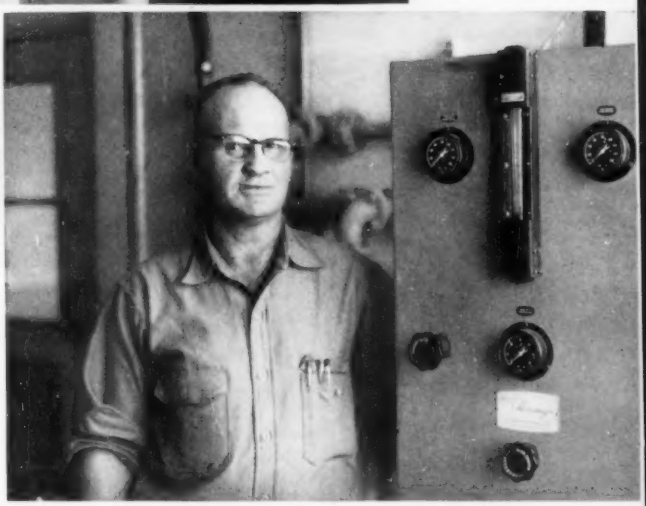
Over 51 miles of 6 in. to 16 in. cast iron mains, with "Roll-On" type of joint are being laid in El Cajon Valley, Calif. by contract. The specifications require sand backfill around cast iron pipe in medium corrosive soil; complete sand backfill to within a foot of subgrade in all state highways; decomposed granite backfill in the upper foot of the trench for subgrade; 90% compaction in all backfill; pavement replacement with like pavement to that removed; and all pipe tested after installation to a pressure equal to the class of the pipe.

"El Cajon, California Water System Nears Completion". By M. J. Shelton, Gen'l Mgr. *The U. S. Piper*, March.

Electrodialysis for Treatment of Saline Waters

The authors compare the costs of reducing to the USPHS drinking water standard, a typical saline well water, having 643 ppm of chloride, 581 ppm total hardness, 287 ppm sodium and potassium, and 1617 ppm total dissolved solids; with some Ca., CO_2, SO_4 and others. The methods discussed are multiple-effect evaporation, vapor-compression distillation, flash-type distillation, ion exchange, and electrodialysis. The last is the most recent development in the studies of the problem being made by the U. S. Dept. of the Interior. It utilizes the properties of semipermeable selective ion membranes. Ferrous, calcium and magnesium cations tend to precipitate on the membranes, and should previously be removed by some pretreatment method. The estimated costs per 1,000 gal. of finished water, including fuel, labor, maintenance of equipment, chemicals and capital charges, of each of these processes when furnishing 2 mgd of treated water, in the order in which the processes are named are $2.45, $0.84, $1.37, $0.87; and $0.65 to $0.48 by the electrodialysis process, depending on the pretreatment method employed.

"Cost Estimates Favor Electrodialysis For Treatment of Saline Waters". By David E. Smith, Prof. of C. E. at Univ. of Fla., and Charles E. Richheimer, *Civil Engineering*, April.



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This is Supt. McCormack of the Monterey, Cal. Sewage Works — standing beside Builders Model DVS-A Automatic-Proportional Chlorinizer. Except for the small dribble of clear water for chlorine control valve pressure, this simple chlorine gas feeder operates entirely on reclaimed sewage effluent, providing an important economy in the plant's operating budget. The rate of chlorine dosage is governed by a Builders Chronoflo Effluent Meter which automatically and accurately proportions the chlorine feed to the effluent flow.

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Tastes and Odors Caused by Actinomycetes

Tastes and odors often occur in streams that appear to be devoid of microorganisms. Research by the authors indicates that aquatic actinomycetes are responsible for a large proportion of the tastes and odors that occur sporadically in the water supplies of many cities whose supplies come from streams, lakes or overflow reservoirs. Actinomycetes filaments associate themselves with algae, higher plants or other sources of nutrition, and during early stages of growth produce fairly high concentrations of tastes and odors, which generally occur in a regular sequence: first a fishy odor; then a strong grassy taste, followed by strong pungent marshy odors and then by a slightly musty taste and odor. Each of these lasts two to ten days, and the later stages occur only if there is adequate food for the actinomycetes. These are not vulnerable to concentrations of copper as high as 50 ppm nor chlorine as high as 25 ppm. Consequently the authors know of no control that may be used in fertile waters to reduce these organisms. For treatment in the water plant, prechlorination or activated carbon may be effective in removing fishy odors; not so effective for marshy or grassy odors, for which chlorine dioxide or "Odorex" may be more effective. Woody and earthy odors cannot be removed from raw water economically.

"Tastes and Odors in Water Supplies—Actinomycetes". By J. K. G. Silvey, Prof. of Biology, and A. W. Roach, Assoc. Prof. of Biology, North Texas State College. PUBLIC WORKS, May.

Washington's Unusually Flexible Pumping Station

The Bryant St. pumping station in Washington, D. C. has been called the most modern in the world. Originally operated by steam power, by 1953 ten new motor-operated pumps had been installed. Controls at the operator's station are placed on a color-coded diagram of the plant piping arrangement, and provisions have been made to give the utmost flexibility to plant operation. This plant distributes through four separate service systems—low service, first high, second high, and third high; the last serving elevations between 210 and 350 ft.; low service being between 0 and 70 ft. above sea level. Each of these can be served by any necessary number of pumps; and it is possible to transfer flow from any high service to a lower one by means of valves and pressure regulators. These pressure regulating valves are set for predetermined delivery pressures, and each has a control designed to regulate flow pressures in its own service and the one, two or three lower services. Pumps are closed down when necessary by a cone valve which automatically closes the pump discharge valve 90 percent in ten seconds, then cuts down the closing rate to complete the closing in about five minutes, thus avoiding excessive surges.

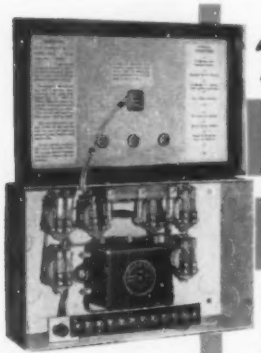
"Water Pumping Station Has Unusual Flexibility". PUBLIC WORKS, May.

Other Articles

"**Plastic Pipe** Found Suitable for Potable Cold Water Supply". By Walter D. Tiedeman, of Nat'l San. Foundation Testing Lab. Civil Engineering, April.

"125 Years of Notable Water Works **Development at City of St. Louis**". By William B. Schworm, Sr. Chem. Engr. Water Works Engineering, April.

"**Tunnel Construction** at Chicago". By George S. Salter, Chf. Filtration Eng'r. Jour. AWW Ass'n, March.



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"**Quick Decision**, Fast Design and Break-Neck Construction Schedule" by St. Louis Co. Water Co. By H. O. Hartung, Supt. of Production. Water Works Engineering, April.

"**Atlanta Builds New Shop** to Serve Mechanized Water Works System". By Paul Weir, Gen. Mgr. Water Works Engineering, April.

"**St. Petersburg**, Fla. Enlarges Its Well Water Supply System". By Paul E. Langdon and Carl W. Reh, Eng'rs. Civil Engineering, April.

"**Salt Water Encroachment**—A Water Resource Problem". Elucidation of principles involved. By A. P. Black, Prof. of Chem., Univ. of Florida. Water Works Engineering, April.

"**Bloodworms** in Distribution Systems". General description, remedies, etc. By J. K. G. Silvey, North Texas State College. Jour AWW Ass'n., March.

"Opportunities in **Water Supply Engineering**". By Karl Hoefle, Supt., Dallas, Tex. Water Dept. Public Works, May.

"**Nepal's Water** Supply Problems Reviewed by an American Engineer". By K. C. Lauster of U.S.P.H.S. Civil Engineering, April.

"**Disinfection** of Public Water Supplies". An operators' manual on laboratory control. By F. W. Gilcreas, Prof. of San. Sci., Univ. of Florida. Water Works Engineering, April.

"34-year-old **Delaware Water Project** Reaches Final Construction Phase". By **Karl R. Kennison**, Chf. Eng'r. Water Works Engineering, April.

"The Use of **Photometric Instruments** for Colorimetric Analysis of Water and Wastes". Description and methods of use. By J. Carrell Morris, Assoc. Prof. of San Chem., Harvard Univ. Public Works May.

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Fluoridation and the Courts

(*Continued from page 94*)

Cleveland, Ohio; Tulsa, Oklahoma; Bend, Oregon; Greenville, South Carolina; and Milwaukee, Wisconsin. In one instance, in Shreveport, Louisiana, a trial court granted a preliminary injunction against fluoridation, but this was later reversed by the Supreme Court of the State.

At the end of 1955 six of these original eleven cases had been passed upon by courts of appeals, and in every instance fluoridation had been sustained as valid and constitutional. Three of these decisions were appealed on constitutional grounds to the Supreme Court of the United States, but the highest court in the land refused in each instance to overturn the ruling of the state court. In one other case, that from Fargo, N.D., the trial court had sustained a demurrer by the city against the plaintiff's case. On appeal, the Supreme Court of the State overruled this action, holding that the case should be tried on its merits, but did not itself pass upon the legality of fluoridation.[2]

The first of these cases to be adjudicated by an appeals court was the one which arose in San Diego, California. A taxpayer of that city filed an action in Superior Court to enjoin the mayor and city council from adding 1 ppm of fluoride to the municipal water supply, as authorized by resolution of the council after extensive hearings. The taxpayer charged that there was violation of various constitutional rights, including that of religious freedom, and that fluoridation was so-called "mass medication". The Superior Court found for the city, a decision upheld by the District Court of Appeals, which pointed out that determination by a legislative body of the need for fluoridation was conclusive so long as it was reasonable, which it was. As a last resort the taxpayer appealed to the Supreme Court of the United States, but this court denied a writ of certiorari[3].

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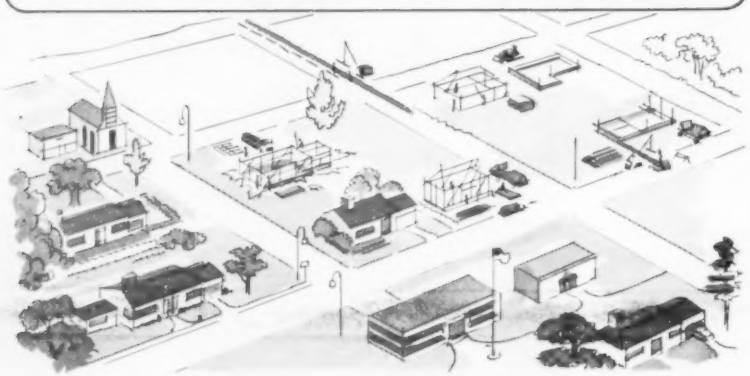

In the U. S. A. today it has been estimated we are using 175 billion gallons of water a day. Leading authorities say that 25 years hence consumption will be 350 billion gallons a day, due to the rapidity of urban growth and industrial expansion.

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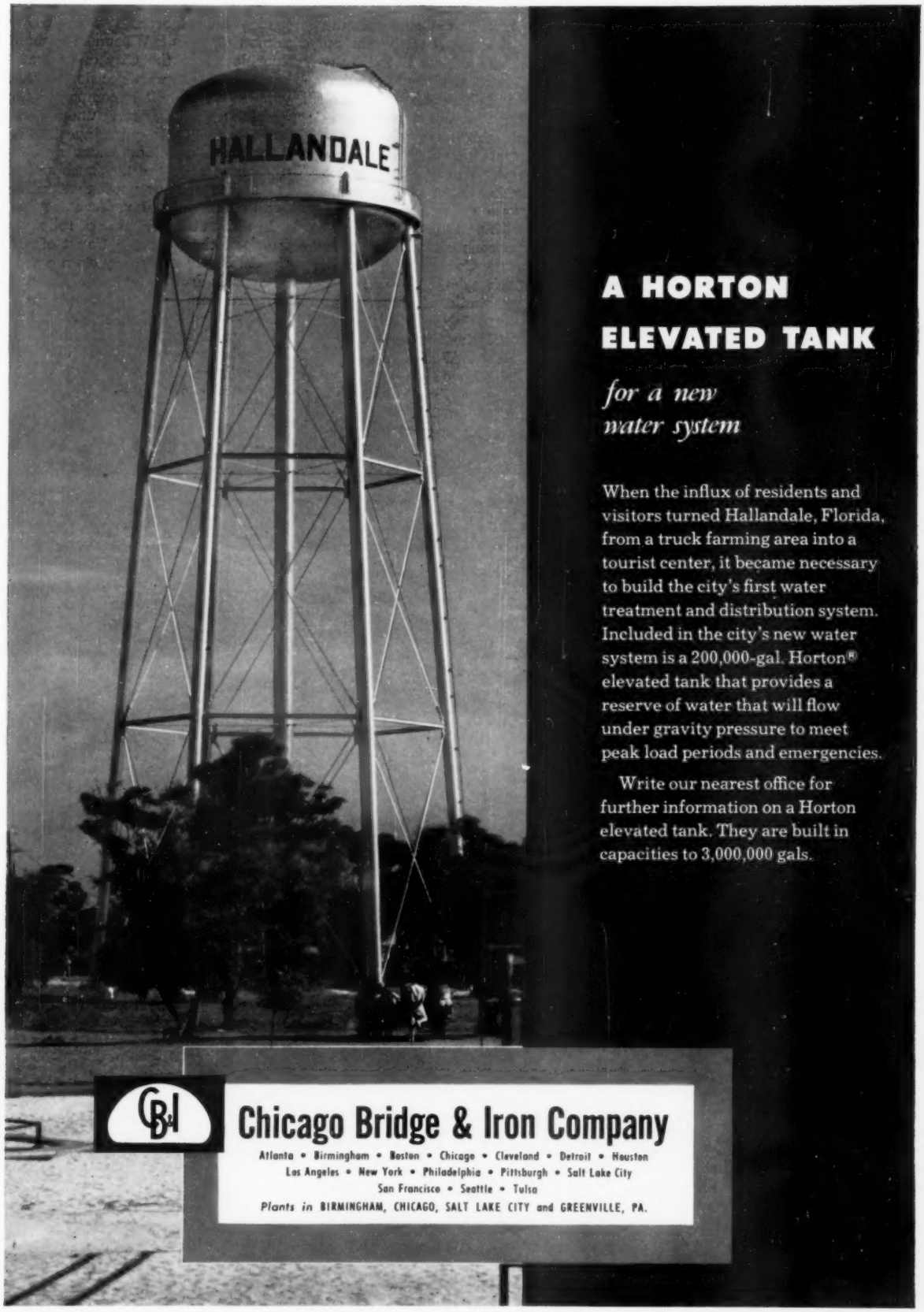

A HORTON ELEVATED TANK

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In Ohio precisely the same type of action was brought by a taxpayer in the Court of Common Pleas for Cuyahoga County to enjoin authorities of the City of Cleveland from adding fluoride to the municipal water. The plaintiff contended that treatment of the teeth was a private and not a public matter, and claimed the right to be free of "medical experimentation" and the right of religious freedom. In a lengthy and comprehensive opinion the Common Pleas Court examined every legal and scientific aspect of the problem, and upheld the city's right of fluoridation. This noteworthy decision was affirmed by the Court of Appeals in 1954, and reaffirmed by the Supreme Court of Ohio on June 29, 1955, the latest decision on the subject to be reported at the end of 1955[4].

In its unanimous decision this court stated that dental caries definitely is a public health problem, and that the proper use of fluorides in public water supplies as a partial preventive of this disease is not an experimental but an established method. Dissent by some, said the court, does not make the method experimental. There was no infringement of constitutional liberties, especially since the rule is that liberty implies the absence of arbitrary restraint, not immunity from reasonable regulations and restrictions imposed in the interests of the community.

In only one instance have the opponents of fluoridation prevailed in court, and then only temporarily. An injunction against the use of this process in Shreveport, Louisiana, granted by a judge of a District Court, was reversed on appeal by the city to the Supreme Court of the State. After outlining the scientific evidence in support of fluoridation, this court stated that any legislation which will better equip children by retarding or reducing dental caries is of great importance and beneficial to all citizens. The measure was held not to be arbitrary or unreasonable, not medication, not adulteration, not class legislation, and not in violation of any constitutional privilege, including religious freedom. There was, remarked this court, no compulsion to drink the water. This decision was appealed to the Supreme Court of the United States, which dismissed the appeal as lacking in any substantial federal constitutional question[5].

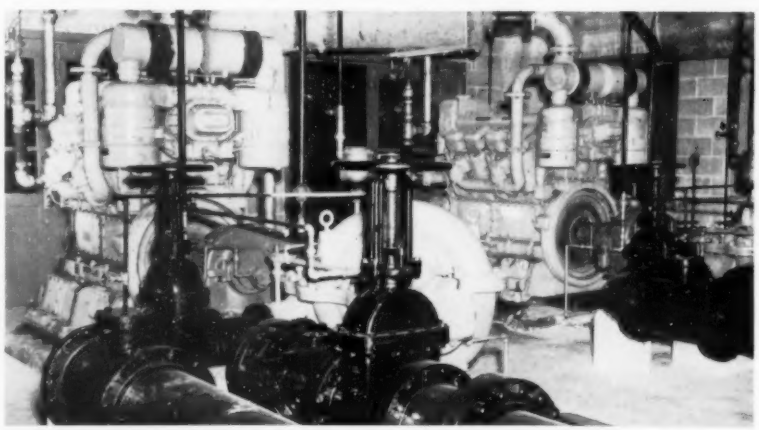
Action by a taxpayer to enjoin fluoridation of the water supply of Tulsa, Oklahoma, was denied by the District Court in 1953. On appeal, the Supreme Court of the State sustained this decision in an opinion which declared that the weight of well-reasoned modern precedent upholds the right of municipalities to adopt such reasonable and undiscriminating measures to protect and improve their water supplies, even though no epidemic is imminent and no contagious disease or virus is directly involved. This decision was also appealed on constitutional grounds to the Supreme Court of the United States, which denied certiorari, shortly after similar action in the Louisiana case[6].

Late in 1954 the Supreme Court of the State of Washington sustained the right of the City of Chehalis to adopt fluoridation and rejected the contention of a taxpayer that this process represented mass medication. This was a majority decision, however, with vigorous dissents by three of the justices[7]. In March, 1955, the Supreme Court of Wisconsin upheld fluoridation in the City of Milwaukee in a unanimous decision, which pointed out that it is competent for legislative bodies, acting under their police power, to require ingestion of fluorides in drinking water sold as a public utility, and that such action is in the interests of the public health and general welfare[8].

In discussing the issue of religious freedom, the Supreme Court of the United States and many state courts of appeals frequently have asserted that freedom of belief is absolute, but that freedom of action is not. The established rule is that anyone is at liberty to follow the tenets of any religion, or none, but that in the practice of any religion no one can violate federal, state, or municipal legislation properly enacted and reasonably enforced in the interests

(*Continued on page* 176)

Two Cat Diesels Pump Water for Port Washington



● **PUMPING STATION at Port Washington, L. I., New York houses two Caterpillar Diesel D375 engines which drive DeLaval centrifugals, each with 1500 gpm capacity.**

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of the public health and the general welfare[9].

Whenever the exercise, or alleged exercise, of the vested right of religious freedom has come in conflict with public health laws and procedures, which likewise have a solid constitutional basis, it is the public health which invariably has prevailed, and in the nature of things must always prevail[10]. Fluoridation of municipal water supplies not only is now an accepted and established scientific procedure, but it is sanctioned by the law of the land.

[*Editor's Note*: Since this article was written, fluoridation of a city water supply has been upheld as valid by the Supreme Court of Oregon in a decision handed down on January 11, 1956; Baer v. City of Bend, 292 P.2nd 134.]

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Hundreds of homes and business establishments in the Elm Park section of Worcester, Massachusetts, were without water following a break at the junction of a three-branch 16-inch water main. The R. H. White Construction Company of Auburn, Massachusetts, called in to handle emergency repairs, used a

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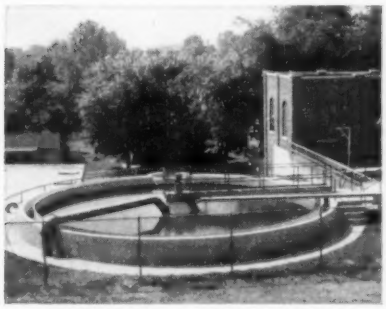

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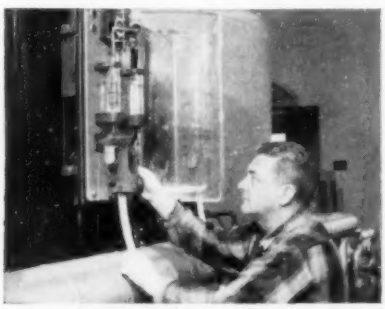
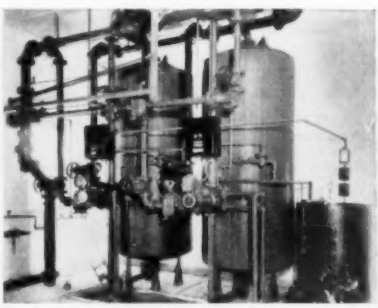


HARDNESS TESTER starts regeneration of softeners automatically, saves manpower. E. Aurora, N. Y. Village Eng.: *E. J. Maurer.*



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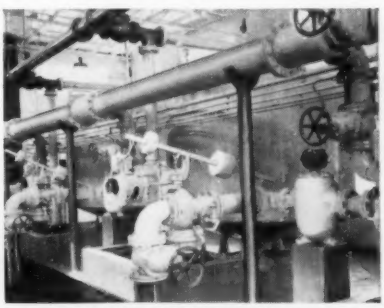

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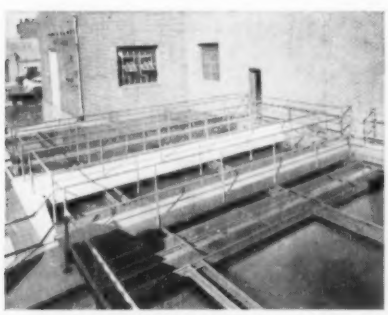

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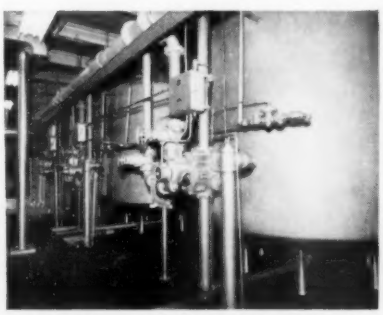
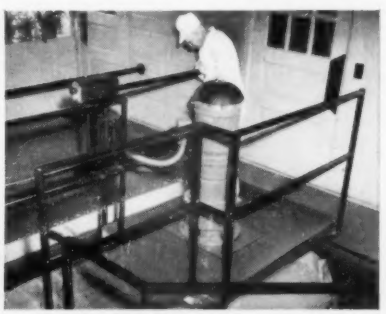


SOFTENER CAPACITY TRIPLED and $7,000 yearly saved on salt by change to Permutit Q resin. Normal, Ill. Cons. Eng.: *Farnsworth & Conley.*



TRIPLE TROUBLE! 275 ppm hardness, 200 ppm alkalinity, 3 ppm iron are reduced by this Precipitator. Staples, Minn. Supt.: *E. H. Klang.*

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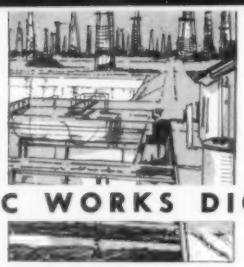


PUBLIC WORKS DIGESTS

THE INDUSTRIAL WASTE DIGEST

Air Pollutant Removal at High Temperatures

Removal of particulate material from gases at temperatures in excess of 1000° F. is of importance in air pollution control as well as metallurgical industries. Development of a ceramic fiber by the Carborundum Company capable of withstanding temperatures as high as 2000° F. for prolonged periods made possible the study of the factors involved in filtration of gases at high temperatures with a practical objective of development of a system for removing solid radioactive components from hot exhaust gases discharged from an atomic energy testing facility. The experimental procedures consisted of blowing room air through an electric air heating furnace to a duct in which a filter made of the fibers was placed. Copper oxide dust was injected into the air stream to assimilate the radioactive material. Up- and downstream air samples were collected. Test filters employed were from three different fiber sizes with a mean diameter of the fiber varying from 4 to 20 microns. The open face filter area was 6 x 6 inches. The dust cloud entering the filter had a mass median diameter of 8.5 microns. Temperature, flow rate, and filter resistance were noted at 10-minute intervals. Dust loadings ranged from 10 to 40 grains per 1000 cu. ft. of air. It was found that the rate of dust removal decreases rapidly with depth of the filter. It was further observed that the density of the packing affected efficiency, the lighter pack having a higher efficiency. Other factors influencing efficiency were temperature, with filter efficiency decreasing with an increase in temperature; velocity, with an efficiency decrease with an increase in flow rate; and fiber size, with the finer the fiber the smaller the particle removed at high efficiency. Chemical resistance of the fiber to the collected dust was checked, and while some combination was taking place between the fiber and copper dioxide, there appeared to be no measurable effect on fiber embrittlement or strength.

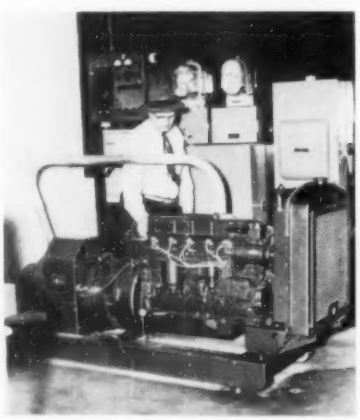
"High Temperature Dust Filtration," By Melvin W. First, Newton Centre, Mass., J. Barrie Graham, Buffalo Forge Co., Buffalo, N. Y., Gurdon M. Butler and Claire B. Walworth, Carborundum Co., Niagara Falls, N. Y., and Roy P. Warren, Buffalo Forge Co., Buffalo, N. Y. *Industrial & Engineering Chemistry,* April.

Treating Effluent from a Rubber Research Laboratory

In the development of a rubber research laboratory in the Wayne Township of New Jersey, the United States Rubber Company became aware of an aggravated waste disposal problem. Because the receiving stream is also the source of the water supply, at a point only five miles distant, of the Passaic Valley Water Commission, the New Jersey State Department of Health placed stringent restrictions on the quality of the waste effluent being discharged. The increments of the wastes were found to be cooling water, sanitary, chemicals, and polymer. The relative proportions of these components on a volume basis were estimated to be respectively 82.6%, 7.4%, 8.8%, and 1.2%. Efforts were made to analyze the characteristics of the chemical and polymer wastes since these appeared to present the major portion of the problem from the standpoint of objectionable constituents. The chemical wastes were found to vary widely as to pH, total solids, dissolved

Stand-By Power For An Emergency

SHOULD CENTRAL electrical power fail, the new city garage of South Portland, Maine can fall back on emergency power so plentiful that it assures uninterrupted operation of lights, car and truck radio communication and three-phase machine shop operation. This full protection comes from a 35 KW electric plant, manufactured by Kohler Co., Kohler, Wisconsin, which was installed in late 1955 in the city's new garage.



● **STANDBY POWER for the South Portland, Maine, Public Works Department is provided by this 35 KW plant.**

The plant is powered by gasoline and is two-wire remote-controlled. It has a 6-cylinder, liquid-cooled engine with a 4-inch stroke and 4⅛-inch bore which develops 81 hp at 1800 rpm.

When the public works department first installed stand-by power, some years ago, its original installation was a small generator supplying 1000 watts and capable of keeping only radio communication going in case of emergency. A few years later a 10 KW unit replaced the small generator, but this was soon found inadequate to the task of keeping the machine shop, as well as the radio and the lighting system, in operation. Because the continued operation of the machine shop during emergencies was considered a "must", city engineers decided that a high-output generator was imperative. This Kohler unit was installed under the direction of Phillip Webster, Mechanical Supervisor for the Public Works Department.

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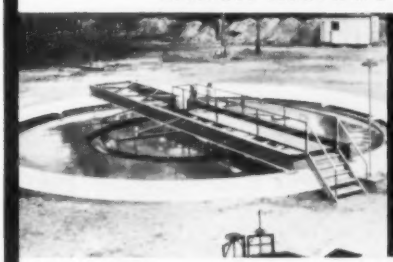
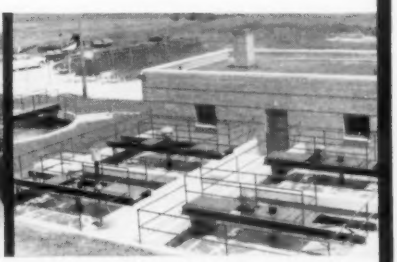
which includes..

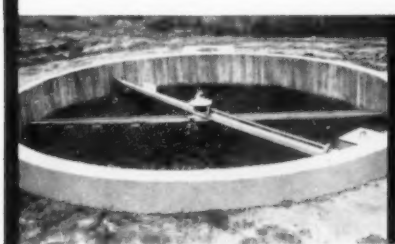


..SPIRAFLO CLARIFIER for both primary and final clarification of domestic and process wastes. A clarifier of radically different design, the Spiraflo offers complete settleable solids removal; greater removal of finely divided particles; positive grease, scum oil removal; uniform velocity throughout tank; and straight wall design which reduces construction costs.

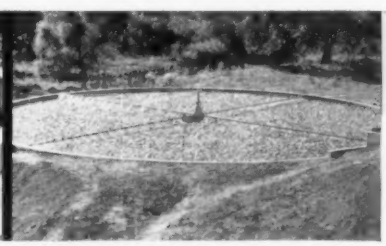
..the HI-CONE, the most important development in the surface aeration process of activated sludge treatment in the last 30 years. The Hi-Cone offers much greater circulation, and can handle substantially more sewage with no increase in power consumption per MG treated. Maintenance costs are minimized because nothing can clog.



..the CAVITATOR, a newly developed Yeomans unit for low cost treatment of both domestic sewage and industrial wastes. Perfectly suited for small communities, subdivisions, motels, resorts, schools and industrial plants, the Cavitator has excellent purification efficiency, extremely high oxygen transfer efficiency, and extremely low air requirements per pound of B.O.D. removed.



..the WATER-WHEEL, a rotary distributor used with trickling filter systems in the secondary treatment of sewage. An exceptionally rugged, yet simple piece of equipment, the Water-wheel provides uniform distribution over the entire filter bed at all flow rates .. even the lowest. Costly accessories, such as underground feed pipe, dosing chamber with siphon, center support, and mercury seal, are not required.



.. YEOMANS ROTARY DISTRIBUTORS (both standard rate and high capacity). Standard rate units distribute evenly across the entire filter bed .. adjustable nozzles produce fine, well-aerated spray which carries down high volumes of oxygen. For high capacity filters, both the Yeomans high capacity type distributor and the Aero-Filter system are available.

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solids, and BOD. It was found that the BOD of the waste could be reduced by aeration at elevated temperatures. The principal contaminants in the polymer wastes were synthetic rubber particles, organic solvents, inorganic salts, and synthetic detergents. Research indicated that the suspended and colloidal constituents could be removed by coagulation with alum or ferric chloride followed by settling or flotation and that detergents and organic solvents could be adsorbed with activated carbon. A decrease in the BOD to an extent of 85 percent was found possible with further reduction by means of aeration with activated sludge. It was decided, however, that because of the extremely variable volume and character of the waste, control of this type of treatment would be difficult. The method finally selected consisted of evaporating of most of the water and volatile components by means of a submerged gas burner. The destruction of phenols may be accomplished by mixing the chemical waste with sewage and aerating with activated sludge. The polymer waste will be collected in an equalization basin and concentrated by evaporation to 10% of its original volume. The resulting slurry will be conveyed to drying beds and the dried material carted away.

"Effluent Treatment Study for a Rubber Research Laboratory," By A. L. Nicolai, U. S. Rubber Company, New York, W. W. Eckenfelder, Consulting Engineer, Leonia, N. J., and D. G. Gardner, U. S. Rubber Company, Passaic, N. J. *Industrial Wastes*, March-April.

Industrial Pollution Control

The fundamental principles which have become important factors in the success of industrial research are economic justification, deliberate creativeness, and an integrated program. In the economic justification of a project, a cost balance should be observed, weighing the cost against the probability of success and the estimated savings. The economic evaluation of a new or modified manufacturing process is not complete unless pollution control costs have been included. Research in pollution control should not be the sole responsibility of the waste producing industry. Firms engaged in the sale of supplies and equipment for waste treatment should be concerned: and fundamental research, especially that essential to the establishment of regulatory measures, may be considered the burden of governmental agencies. Where research projects are beyond the scope of individual company sponsorship, it is advantageous for the company to participate in trade association sponsored projects or farm out the project to institutions or consultants equipped for such purposes. In effecting deliberate creativeness, it is necessary to set and achieve specific goals with orderly and persistent effort. An integrated research program is advantageous in all pollution control work where the program consists of exploratory, bench, pilot plant, design, operational and product application measures. Such a program has the advantage of coordination of effort. In considering the inter-industry relationships of the waste control problem, industrial waste research should be basically non-competitive, and thus industries may join through trade associations for the solution of common problems. In its relations with regulatory agencies, industry can educate governmental personnel concerning its problems through the publication of research data, the activities of various trade and profes-

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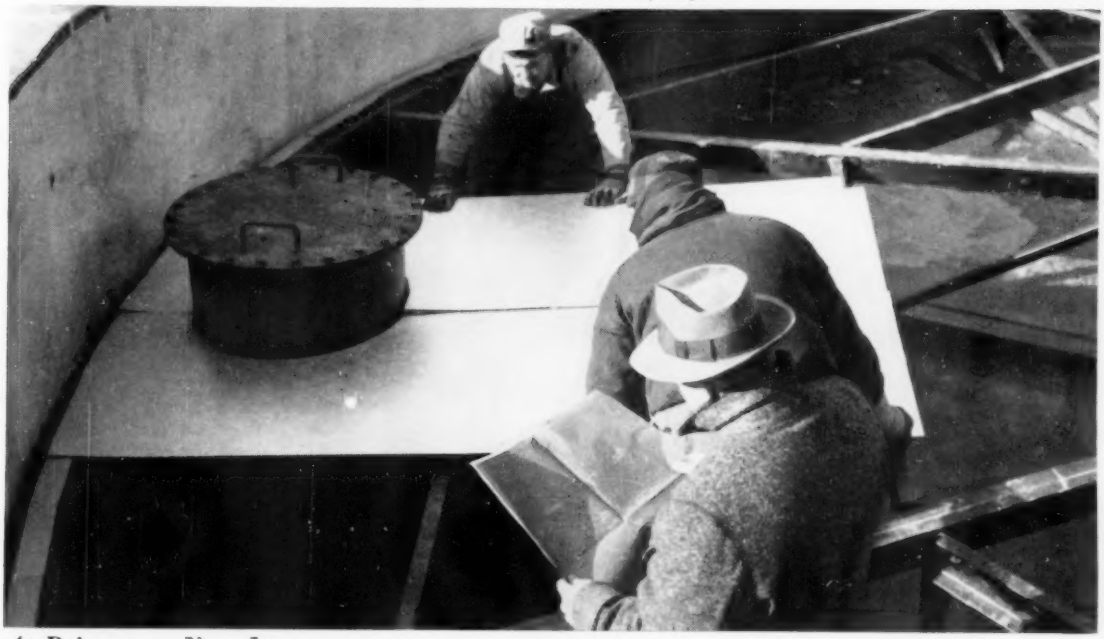
Prefabricated aluminum roofing shown during installation at Princeton, N. J.



At Princeton, New Jersey . . .

PFT metal roofing on new floating cover provides longer life, better insulation

Section of roofing showing (1) aluminum top sheet, (2) inch-thick fiber-glass insulation, (3) aluminum reinforcing channel, (4) corrugated supporting ribs.

In expanding and improving its sewage treatment plant, Princeton's engineers considered immediate results *and* long-range economy, chose a *PFT Floating Cover* with *metal-clad roofing* for its new 35′ digester.

The reasons were specific—metal roofing offers four distinct advantages over conventional wood types: (1) longer life—equal to the life of the cover itself, (2) more efficient insulation, (3) fewer maintenance problems, (4) easier assembly and installation.

PFT metal roofing consists of prefabricated sections with embossed aluminum top sheets, each piece marked for easy assembly at the plant site. The sections are designed for close fitting in the field with a 3″ lap of top metal covering at all joints (see illustration). Cutout sections are provided to fit around sampling walls, hatch framing and manholes.

The completed 35′ Floating Cover as it looks today.

With fiber-glass insulation, PFT metal roofing resists heat loss and keeps digester heating costs at a minimum.

The cover is designed for later installation of PFT's *Pearth Gas Recirculation System*—an economical process that controls the formation of scum, making more effective use of the entire digestion tank capacity.

Congratulations to Princeton on their modernized plant and far-sighted planning!

Design of plant by / *I. Russel Riker, Borough Engineer*

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sional associations, and personnel contacts. Maintenance of good public relations is also important.

"Research and Industrial Pollution Control," By Roy F. Weston, Consulting Engineer, Newtown Square, Pennsylvania. *Industrial Wastes*, March-April.

Coal Mine Slag Drainage

Drainage from slag remaining from strip mining of coal at processing plants and from roads and other improvements constructed of slag constitutes one of the principal pollutants of some Illinois waters. Slag drainage accumulates in ditches and puddles and is flushed into the streams by heavy rains and commonly results in fish kills. A study was conducted to establish the concentration of slag drainage necessary to cause fish mortality and the characteristics of the waste associated with the lethal concentration. Sunfish, largemouth bass, and carp were placed in tanks filled with river water from areas where slag pollution occurs. After a period of acclimation for the fish during which the water was aerated, the aeration was stopped and tests were made for pH, total acidity, mineral acidity, alkalinity, specific conductance, dissolved oxygen, and ferrous and ferric iron. Concentrations of the pollutants were varied. The batch of pollutants used had a total acidity equivalent to 1360 ppm, $CaCO_3$, pH 2.3, total iron 2700 ppm, specific conductance 8000 reciprocal megohms. The lethal concentration of the pollutant was found to be about one to fifty. The approximate value of the different variables associated with this concentration were pH 3.5, a specific conductance of 800 reciprocal megohms, total acidity of 120 ppm, mineral acidity 30 ppm, ferrous iron 3.2, and alkalinity and ferric iron 0.0. Examination of the dead and dying fishes indicated gill irritation thought to be due to the low pH. In order to establish this, concentrated sulfuric acid was added to the aquarium until a pH of 3.7 was reached. The fish developed gill irritation and were killed exactly as those subjected to the mine waste pollutant. Consequently it was concluded that the lethal effect of slag results from the free acid present.

"Coal Mine Slag Drainage" By William M. Lewis, and Charles Peters, Cooperative Fisheries Research Laboratory. *Industrial Wastes*, March-April.

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Electric Utilities and Air Pollution

The amount of fuel-generated energy now required to supply the Pacific Southwest is 454 percent greater than in 1945. The demand for natural gas as a fuel in the area has outstripped available supply in spite of extensive imports. Industrial utilization of natural gas has been curtailed in favor of providing adequate supplies to domestic customers. This has made industry dependent upon fuel oil to supplement gas for power generation and other uses. Air pollution control programs have emphasized the low sulfur content of fuels or control of sulfur products and stack gases. The problems involved in removal of sulfur from fuel oil are still too complex to permit complete solution. Given time, it seems probable that removal of sulfur products from stack gases will be accomplished. In the California Pollution Control Act there seems to be discrimination against industry since municipal-owned utilities enjoy immunity. Furthermore, the rules and regulations of the Los Angeles air pollution district are based to some extent on the Ringelmann chart with respect to opaqueness. A case is still pending in the courts of Los Angeles County which will probably determine the validity of this method described by the electrical industry as outmoded and inapplicable to the problem. Progress made by utilities in air pollution control has included the factors of stricter specifications on fuels utilized, design of furnaces, completeness of combustion, and control of combustion through the use of television cameras in viewing furnace fires. These are methods of the Edison Company which also has an extensive program of study and research into the field of air pollution abatement.

"Electric Utilities and the Air Pollution Problem," By W. L. Chadwick, Southern California Edison Company, Los Angeles. *Industrial Wastes,* March-April.

• • •

Subsurface Utilities

(*Continued from page* 104)

Toronto in 1842 approached 18,000, it became apparent that the transportation of water by pail, barrel and tank could not supply the demand; the first mains were then laid. From that humble beginning, the system has developed into an integrated network with hundreds of miles of water mains. In the next five years, extension of these mains to serve the Metropolitan Area will cost in the vicinity of $40,000,000.

Sewers: Hand in hand with the supply of water has marched the demand for sewers. Toronto's first sewers, probably wooden pipes, were installed before 1840. In general, means for the conveyance of sewage should be supplied along with or preceding the water mains. Storm sewers, some large conduits ten feet in diameter, must also be installed, and the subgrade becomes increasingly crowded. At the time the Metropolitan Municipality was formed, there were approximately 900 miles of sewers in the City of Toronto, and extension of these facilities to serve the Metropolitan Area are presently under way, the estimated cost being $40,000,000.

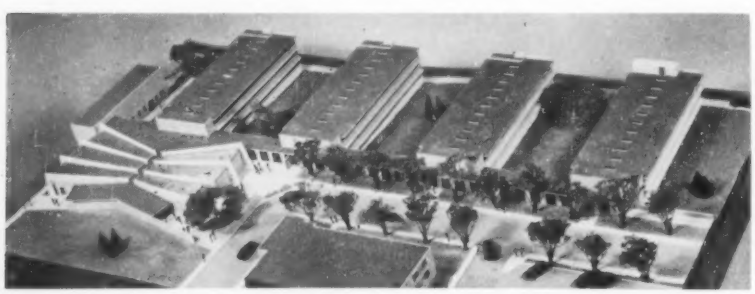
Telephone Service: The Bell Telephone Co. of Canada began operation entirely on overhead wires. Its first underground lines were laid in Toronto, on Jarvis Street, in 1880. During the following years, many more lines were placed underground and the practice has continued in increasing degree up to the present time. The magnitude of the plant installed in the Toronto Metropolitan area is illustrated by the fact that there are now in the system 2,229 miles of underground conduit, 1,904,000 miles of underground wire, and 3,500 manholes. It would be impractical, as well as unsightly, to carry on overhead structures the nearly two million miles of wires now required to serve Metropolitan Toronto. Underground lines are much more compact, efficient and weatherproof.

Hydro-electric Services: The first sub-surface lines of the Toronto Hydro-electric System were laid in 1909. Many of its lines are still carried on poles, but those on heavily travelled arteries and business sections are being replaced by underground installations.

Rapid Transit: One of the most recent demands for a place beneath Toronto's streets was made by the Toronto Transit Commission, for the Yonge Street Subway, which may be only the first section of a complete underground transit system. The existence of public utility plans covering the thoroughfares on which the subway was to be constructed materially reduced the cost of handling the re-location of such utilities. A considerable portion of this subway was constructed by the open-cut method, which entailed the

Proposed Engineering Center for Colorado A & M

One of the first groups of buildings to be constructed by Colorado A & M College, Fort Collins, Colo., under its new building program will be for the School of Engineering. The new Center will consist of three three-story structures connected by an arcade along the south side. In addition there will be a fourth and similar building in the assembly devoted to the work in Physics; and a separate lecture hall with a capacity of 300. Future expansion will be provided for by a fifth similar building in line with the other four, and a similar large lecture hall adjacent to the first one, when the need arises.



All present buildings in which the School of Engineering teaching facilities are housed will be turned over to other departments for classroom use. All departments in the Engineering School will move into the new Center. Each wing will have laboratories of one department on its first floor, but otherwise there will be no departmental significance to a particular wing. All offices, classrooms, drafting rooms, and other facilities will be used jointly and be spread throughout the three Engineering wings.

Construction of this new Center is expected to start next spring, and the new facilities should be ready by the fall of 1957. For the following year indications point to an Engineering enrollment of 800 students.

exposing of all utilities and the temporary supporting of them while the subway was constructed underneath. An appreciation of the existing sub-surface utilities on Yonge Street at the time the subway was under construction may be gained from pictures in this article.

Recapitulation and Comparison

We must add to these underground utilities the many miles of private drains, water, gas and other service lines; over one hundred thousand manholes, valve chambers, service boxes, transformer pits, etc.; certain lengths of pneumatic tubes; and steam and oil lines. In 1937, the sub-surface services averaged 6.2 miles for each mile of street and lane in the City of Toronto and, certainly, this figure has risen sharply since that time.

As the Metropolitan Municipality grows larger, more services having greater dimensions will be constructed underground, and we can be sure that these services will be constructed on a planned and orderly basis with the new Public Utilities Co-ordinating Committee.

• • •

Automatic Lubrication

(*Continued from page 95*)

which would be used in all kinds of service—garbage, rubbish and ash. We chose a brand new unit and had it equipped before going into service. The Automatic - Lubrication system consisted of five Multi-Luber positive displacement injector pumps, two on the Load-Packer and three on the truck. Each pump had twelve outlets which supplied an equal measured quantity of lubricant progressively through the outlets of the pumps to each of the sixty bearings.

The lubricant is conveyed through flexible Nylon lines which are wrapped in harnesses similar to those used on electrical installations. These lines are protected by Vinyl tape and a durable loom. Two oil reservoirs with a capacity of 1.7 gallons each are used to supply oil to the pumps, one taking care of the two pumps mounted on the Load-Packer and the other handling the three pumps mounted on the truck. The pumps are actuated by vacuum which is obtained from the intake manifold of the engine. An automatic timing device energizes the system and causes a lubrication cycle every 45 minutes while the Load-Packer and truck are in operation. This is supplemented by a push button on the dash which can be manually operated by the driver in the event more frequent

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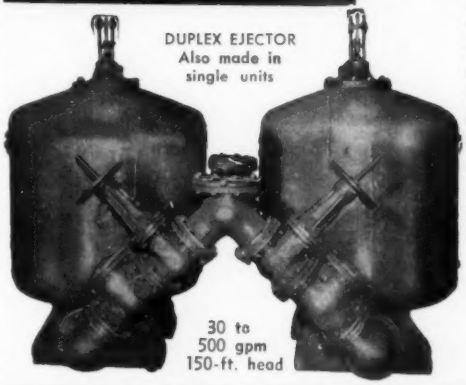

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Dodson's Digest

Even Calcium Chloride can't please everybody

Drove out to see Harry Phillips, a county highway engineer and a good friend of mine. When I got there, he was reading his morning mail.

"Look at this, Dod!" Harry exclaimed. "Every letter in this stack is a complaint about dusty roads. Everybody in town is on my back!"

"What are you doing about it?" I asked.

"We've got the most ambitious paving program in our history," he replied. "We're paving 50 miles of road this year, but that still leaves . . . "

" . . . That still leaves a lot of miles," I broke in, "where traffic isn't heavy enough to justify paving, but which are busy enough to require some improvement."

"You took the words right out of my mouth," Harry said.

"And that's where most of your complaints are coming from," I continued. "If you'll just cut 5 miles from that paving program, you'll have enough money to treat 50 additional miles with Calcium Chloride."

"Makes sense," he admitted.

"And it will give you 95 miles of smooth, dustfree roads instead of 50," I concluded, "and your paving program will still be going strong."

"That sounds like the answer," Harry agreed. "I'll look into it."

I had another appointment, so I left. About a month later, I stopped in again to see how he was coming.

"Dod," Harry said, "it's no use. We tried it, and I'm still getting complaints."

"About what?" I asked

"Look!" he grinned. "Here's one from a gas station. They claim their car-wash business has been cut in half since I started using Calcium Chloride on their road!" —L. D. Dodson

P.S.—For more information on the advantages and methods of using Wyandotte Calcium Chloride to stop bothersome dust, write to me for your free copy of our leaflet, "How to Stop Bothersome Dust." *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

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cycles are desired. The complete operation of the system requires only between five and twenty seconds, depending on temperature, and completion of the cycle is indicated by a signal light on the dash. This signal is wired so that all units are required to complete their cycle before the indicator light can be energized.

After one year of operation, we found that road delays were reduced by more than 20 percent and the cost of maintenance was reduced by approximately two cents a mile over similar units which were lubricated in the conventional way. The test unit has not been out of service for any repair or maintenance work, due to faulty lubrication, during the past two years. In addition to this, the operating personnel report wonderful ease of operation, particularly as regards to steering.

This information was submitted to our Budget Director who suggested that a more complete check be made and recommended that four additional garbage and rubbish trucks be equipped with Multi-Lubers.

Equipping these additional trucks has convinced us that we can greatly reduce our maintenance cost, eliminate many road delays and increase the life of our equipment from one to two years. We are, therefore, specifying Multi-Luber Systems as standard equipment on all closed packer trucks which will be purchased in our 1956-57 budget, and if our findings continue to be as favorable with Multi-Luber Automatic Lubrication in the future, we no doubt will include it as standard equipment on all our vehicles, including Police scout cars.

• • •

Stream Pollution

(*Continued from page* 101)

above Station 1 results in an appreciable DO deficit below saturation at this location, the deficit should be taken into account in the basic DO drop formula. This is done by adding another term to the formula. This term is

$$\frac{\text{DO deficit, in ppm}}{\sqrt{\text{Stream discharge, in cfs}}}$$

A constant multiplier such as 100 can be used in the numerator to produce values of convenient size for easy tabulation and calculation. The sign of the b coefficient of this factor should turn out to be negative since the more the deficit at this point, the less the additional DO drop to the bottom of the sag beyond this point. The measurement of the BOD load at Station 1 will, of course, permit the separation of the upstream residual load from the particular load, or loads, under study.

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Number of DO Profiles—If samples are collected about once a week throughout late spring, summer, and fall, some 20 or more individual sets of data and profiles will be obtained. The data resulting will ordinarily be found to be sufficient for this method of analysis. It should be realized that merely 20 sets of data, assuming all data were collected in a few days time, would not be satisfactory. This is because in such a short period of time it would be impossible to observe a sufficient range in each of the variables, DO drop, BOD, temperature, and stream flow to allow the dependable prediction of DO drop for conditions very much different from those observed.

By spreading the observations over a period of several months, temperatures and discharges will vary over quite a range due to weather conditions. The chances of the load varying are also good, in most situations at least, during this period of time. The individual sampling runs should not all be on the same day of the week or the same hour of the day. At least a few observations should be made at night.

Algae are of such importance in their effect on DO concentrations that the lowest DO values are usually observed just before dawn. Since DO variations due to algae exhibit a definite cycle trend, it is desirable to collect the samples from all stations as concurrently as possible. This is done to get all DO values on the

same part of the cycle and thus to eliminate from the study as much as possible of the influence of the algae-added oxygen, in the daytime and the algae-used oxygen, at night.

Since the method of analysis described herein predicts the DO drop as a decrease below that observed just above pollution, it is apparent that when critical oxygen concentrations are considered, the minimum oxygen concentration observed or expected above pollution should be used. This will mean the effects of algae are of particular importance here.

The exact number of sampling runs needed in a particular situation can be determined only by the desire of the investigator to achieve accuracy and dependability. In this method of analysis, and in only this method of analysis, can the investigator determine how close to the truth his predicted values of DO probably are. Methods for doing this (computing confidence limits) are described in standard statistical texts such as that of Ezekiel[6], and of Snedecor[7]. It goes without saying that the more data available, and the better the distribution of the data, the better the results will be.

Variation in Procedure—For some particular reason it may be desirable to predict the DO drop to a fixed location, such as to one of the sampling stations. In this case the observed DO drop to the location in question is used, along with BOD, temperature, and discharge data at that location, in determining the constants in the DO drop equation. In this way the DO drop to each sampling station can be predicted and a profile drawn for consistent conditions from station to station. This procedure, of course, involves more calculations than the prediction of the drop to the bottom of the sag, but it also produces more information that may be desired in some situations.

Concluding Comments—Since no time of water travel data are needed, and no intensive surveys are required involving large field and laboratory crews, the cost of applying this method of analysis is moderate. Although the details of the procedure can no doubt be improved with use, the procedure in its present form should give reliable results if based on a reasonable number of field observations having a reasonable distribution of values of the variables.

The office calculations required by this method of stream analysis are not as complicated as they may at first appear. No knowledge of mathematics beyond algebra is required. In any case, the office calculations are

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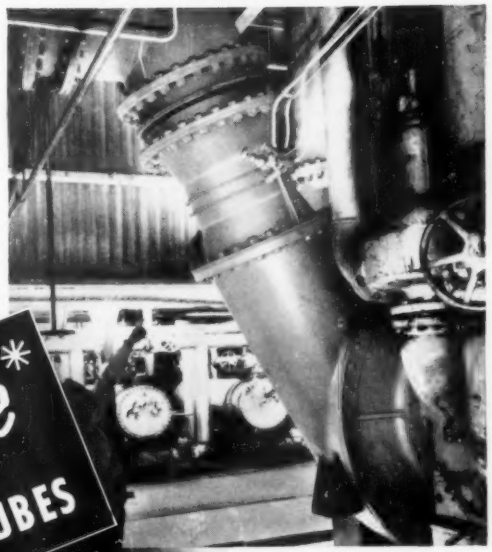

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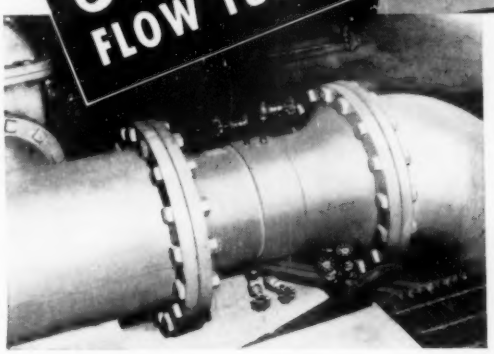

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a minor part of the over-all cost of the studies.

The writer hopes, in proposing the method, that it will encourage more stream studies, and consequently will result in more intelligent determinations of the degree of needed waste treatment.

Acknowledgements — The writer is indebted to the co-author of the original article on this subject, R. A. Buckingham, for his work on that paper. Others contributing valuable suggestions for the original article were S. L. Jones, James C. Pangle, E. C. Tsivoglou, L. A. Young, Paul Richard, T. R. Camp, and G. A. Rhame.

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(*Continued from page* 126)

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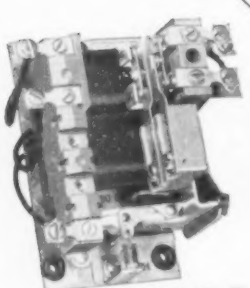

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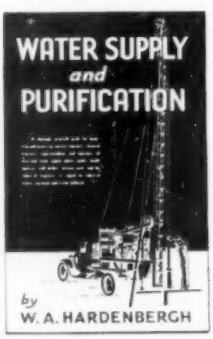

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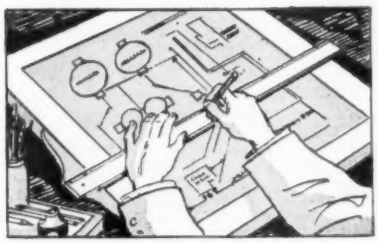

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personal contact between our own management people and a typical cross-section of community residents. We study the files of the community newspaper, appraise current political, economic and social activities of the town. If there are any other industries in town, we talk at some length with the management of each to ascertain community attitudes, sense of responsibility and similar characteristics, as fellow industrialists view them.

We depend, too, on our own powers of observation. We walk along the streets of the proposed plant community, noting the homes, the lawns, the churches, the parks, the schools, the water works.

These little things reveal so much about a community and its residents. Do householders show personal pride in the appearance of their lawns and homes? Do they keep up their schools and churches and parks? Are there enough of these, and other important institutions and facilities to meet the requirements of the population? If not, are the citizens actively and realistically trying to meet the need of the community?

Civic pride and the personal pride of residents are important evidence for an industrial newcomer. In a "good" community we're less likely to be confronted in the future with heavy local tax increases. Also, people are likely to want to "stay put" —which means less personnel turnover with all its attendant costs and problems. Such stability usually goes hand in hand with a sense of proprietorship toward the industry, a desire to cooperate in the growth and well-being of the company on the part of employees and neighbors, alike.

Still another advantage is that management men we move there, and their families, can live happily and we can anticipate finding "home grown" management candidates. Good supervisors are hard to come by, and their morale is important to us.

There are other problems, also. One community, for example, almost broke off negotiations over the issue of a minor improvement to its water system. Another—a community in which we had decided to build a small plant— forgot to mention that the plot they had picked for us was below the level of the city sewer.

In other communities, while negotiations have still been in progress, residents have attempted to gouge our employees seeking homes there by jacking real estate prices un-

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realistically. Again, a small thing, but however small the amount of money involved resentment is instinctive in all of us when moving seems to involve gouging.

How To Keep Industry

So much for attracting industry. But what about keeping the industry a community already has?—especially in the face of unusually high state tax burdens, such as those industry bears in certain states?

Attracting industry and holding on to it are so closely related as to be barely distinguishable——except in degree. An industry will naturally take much more abuse before leaving a community than it will put up with in considering location there. There is no financial loss in simply not building; there are losses and costs in leaving, as well as a feeling of moral responsibility to stay with a plant community.

The community leaders interested in keeping present industry may be helped by placing themselves in the management's position when reviewing the facts. Since most companies belong to stockholders, management's first responsibility naturally must be to them. Its second is to the employees. Its third is to the communities in which the company operates. These responsibilities compel managements to make business-like judgements. Most such decisions are primarily economic—and are reflections of the balance sheet.

A community interested in industrial growth or even in simply maintaining the status quo should first go through all the preliminaries recommended in the textbooks: Community leaders should make a complete survey of the community's industrial assets and so on. They should then go out and sell the community on its own merits—both to new prospects and to the industry they already have.

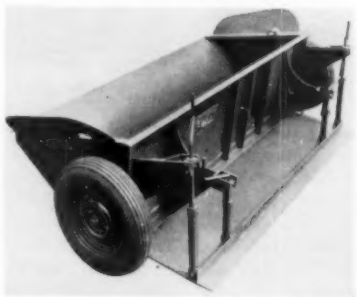
To do this, community representatives should: 1) Protect the interests of industry already within their borders; 2) Avoid making extravagant offers to lure new industry; 3) Refrain from asking their own industries and utilities to put pressure on suppliers to move in to the community; 4) Screen prospective industries in terms of the community's needs and the requirements of the industrial company; 5) keep in mind that "solid" industries like to operate in a "solid" community; and 6) Refrain from expecting too much in the way of immediate or even eventual financial returns from an industry.

PUBLIC WORKS
EQUIPMENT NEWS

Published Monthly **June, 1956**

New True-Lay Paver-Spreader

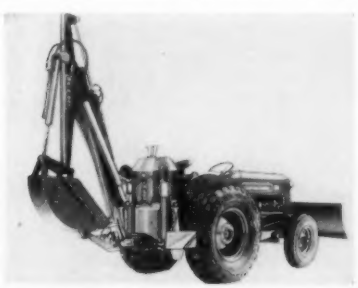
Patented balancing beam, compaction chamber and adjustable hinged screed permitting 75 percent of the unit's weight, plus the weight of the materials to be placed on the screed are features of this new spreader announced by Littleford. Approximately 3 tons are brought to bear directly on the compaction chamber and screed, producing a firmly compacted mat; smooth hot-rolling operations can begin almost immediately. Other features are the pneumatic balancing wheels, chain-hitch attachment and 16-inch hopper throat. Pneumatic tired wheels act as an outrigging, floating over low areas of flexing when encountering uneven grades. The large 16-inch wide hopper throat assures an even, smooth flow of dense material, tight mixes or stone base without bridging or choking. The unit lays up to 100 tons of material per hour in a level mat from 4-ft. to 8-ft. width and to 6-inches deep. For more information write Littleford Bros., Inc., Box 73, 452 E. Pearl St., Cincinnati 2, Ohio, or circle **No. 6-1** on the reply card.



Spreader is easily transported from job to job by means of rubber wheels

Backhoe-Backfill Blade Combination

A combination backhoe and backfill blade attachment for the International 300 tractor has been announced by Wain-Roy Corp. Both attachments are to the subframe, providing a stong mounting which, together with self-leveling hydraulic stabilizers, relieves the tractor itself of heavy loads. The hoe is a complete, self-contained unit and can be removed or attached in less than 30 minutes. The effective digging depth is 11-feet. On the forward end of the sub-frame, a six foot backfill blade is mounted. This blade raises and lowers hydraulically a distance of 18-inches above grade or 8-inches below grade. More details from the Wain-Roy Corporation at Hubbardston, Mass., or circle **No. 6-2** on the reply card.



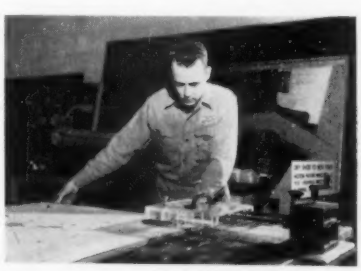
Hydraulic system is simple, positive and operates with finger-tip control

Vibro-Tamper Compaction Efficiency Increases

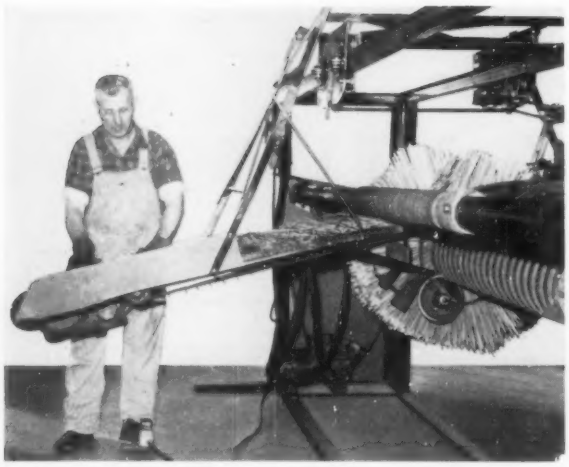
The new Vibro-Tamper announced by International Vibration, achieves its high compaction efficiency by means of six shoes equipped with eccentric rotors in opposition, V-belt driven from a common floating power shaft. With the added rotor weight, each shoe provides a compaction force of over 8,640 lbs. at 2,200 vibrations per minute. The machine can compact single lifts of sand, gravel and other granular materials of up to 12 inches thick in only two passes at a rate of 20 to 38 fpm obtaining as high as 95 to 103 standard modified Proctor density. The machine also handles single lifts of stone of up to 14 inches. Width of compaction is adjustable from 13-ft. 2-in. maximum to 8-ft. 6-in. by removing the two outside shoes. The machine can be operated with one, two or all of the 4 remaining shoes, for narrow approaches, or for highway widening projects with traffic maintained. For convenience of off-highway travel and to speed turnaround, the tamper has been provided with a 1300-lb. retracting counterweight. When the shoes are raised, the counterbalance moves the center of gravity back to counter the weight shift that occurs as the shoes rise. For further information write International Vibration Co., 16702 Waterloo Road, Cleveland 10, Ohio or circle **No. 6-3** on the reply card.

Table Saw Guard Increases Shop Safety

The "Brett-Guard" gives complete protection in the operation of table saws with blades of 6 to 16-inch diameter; a transparent shield allows full vision; and the unit shifts easily to any operating position. Now used by New York City's Department of Public Works, the Brett-Guard will safeguard fingers in any city or county shop. Literature giving a full description of the device and information on a 16-mm sound film, available on loan without charge, are offered by Brett-Guard Co., 5 W. Sheffield Ave., Englewood, N. J. Circle **No. 6-4** on the reply card.



Use Brett-Guard and save your fingers



Filling of rotary street sweeper broom can be an easy job

Hydraulic outriggers give machine stability while digging

Rotary Street Sweeper Brooms Stripped in 1 Minute, Refibered in 8 Minutes

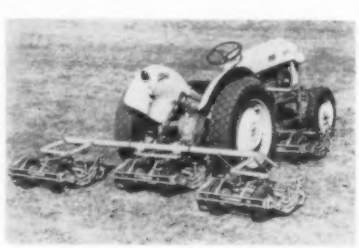
The tedious and expensive operation of stripping and refibering rotary street sweeper brooms is vastly reduced with the "Cor-A-Matic" HD14 machine. With this equipment an operator can strip a five-foot broom in less than one minute and fill the same broom in less than eight minutes. The machine has an automatic feed table suspended from a carriage that runs on a track parallel to the broom core. The power unit of the feed table drives two conveyor belts which carry broom fiber to the cable and the bending mechanism. An adjustable cable fairlead with brake accurately positions and controls tension on the wire cable passing through the bending throat. Further information on the Cor-A-Matic is available from Municipal Research & Development Corp., Jones Bldg., Seattle 1, Washington. Circle **No. 6-5** on the reply card.

New 3-5-Ton Tandem Roller

A new member of its line of variable weight tandem rollers with torque converter, a 3-5-ton model, is announced by Huber-Warco. Specially designed for smaller rolling operations, such as parking lots and driveways, it features a water-cooled, 41-hp engine; a spur-gear final drive; a large capacity sprinkler tank; over-sized, double-plate clutches for forward and reverse shifting; and dual control. The torque converter increases the life of the engine and other vital parts and helps eliminate scuffing by providing constantly smooth drive and reversing action. A curb roller attachment for the tandem makes it possible to iron out paving right up to the edges of walls and obstructions, and to seal pavement against curbs, around poles and next to fixtures. For complete information write Huber-Warco Co., Marion, Ohio, or circle **No. 6-6** on the reply card.

New Highway Tractor Mower

A heavy duty lift type 5-gang mower especially designed for mowing turf areas bordering highways, thruways, freeways, expressways, turnpikes and parkways is announced by Roseman. The tractor mounted mower can be raised hydraulically for travel, for quick transit around abutments and obstructions, and for fast crossing of paved strips without endangering oncoming traffic. A wide range of cutting height adjustment permits the reels to mow down to park like conditions or to cut in a raised position to prevent damage from hidden obstructions. The rear-drive design places the drive wheels behind, instead of at the ends of the reels. Consequently, the outer reels can mow close to trees, guard rails, signs, abutments, markers and over curbs. Complete details from Roseman Mower Corp., Evanston, Ill., or circle **No. 6-7** on the reply card.



Flexible 5-gang design can be reduced to a 3-gang mower by removing pins

New Hyster Hydraulic Backhoe

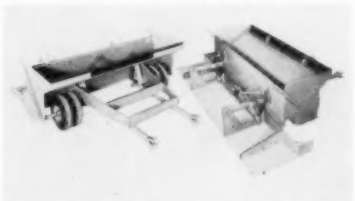
An advanced tractor-mounted backhoe, the D4 backhoe of ½ yard capacity, has been announced by Hyster. Designed for the Caterpillar D4 Tractor, this backhoe has full track-type tractor mobility and is capable of digging down to 13 feet and loading up to a height of 9.6 feet. A rack and gear swing mechanism provides power at uniform speed throughout a full 240 degree arc. For negotiating rough terrain, the backhoe incorporates an equalizer which allows full track oscillation. Dippers are available in cutting widths of 13, 21 or 29 inches. For more information write Hyster Company, 1800 North Adams Street, Peoria 1, Illinois, or circle **No. 6-8** on the reply card.

Heavy Duty Model Concrete Saw

A new concrete saw designed for production sawing on airfield installations, expressways and turnpikes is announced by Eveready Briksaw Co. It is equipped with a 36 hp 4-cylinder, air cooled engine that drives the saw under full load at speeds up to 25 feet a minute. Two abrasive coated drive wheels in direct contact with solid rubber tires give positive traction under all kinds of operating conditions and eliminates slipping, sliding or twisting the blade. Another feature is the "Tip-N-Turn" that allows for quick maneuvering. The unit is merely tipped and then turned in much the same manner as a wheelbarrow is turned. Blade depth control prevents wasteful cuts at depths greater than specified. For information write to Eveready Briksaw, Dept. 347, 1509 South Michigan Blvd., Chicago 5, Illinois, or circle **No. 6-9** on the reply card.

A Towed Spreader For Asphalt and Aggregate

An improved towed asphalt and aggregate spreader has been announced by Miller Spreader. The new unit features a standard floating screed mechanism which moves forward on an even plane no matter



Spreaders come with a floating screed

how irregular the base surface may be. This permits laying of a smooth, level strip ready for rolling. A crown device is now built into the screed, permitting crowns and reverse crowns up to 2½ ins. thick. These spreaders are made in 8, 9 and 10-foot widths and the screeds can be widened through the use of 12-inch extension plates. The spreader will handle limestone, slag and gravel base up to 8 inches in depth at a rate of 1 ton per minute. For additional information write Miller Spreader Corp., 4020 Simon Road, Youngstown, Ohio, or circle **No. 6-10** on the reply card.

Wig-Wag Highway Flasher

A completely new concept in highway warning devices, the Davis Wig-Wag highway flasher, has been introduced by the Davis Emergency Equipment Co. The device makes use of the principle of alternately flashing lights that are used at railroad crossings. The flasher is available for either battery operation, or for 110-volt, AC or DC power line or generator. New plastic magnifying lenses intensify the brilliance of the battery operated units. For full details write Davis Emergency Equipment Co., Newark, N. J., or circle **No. 6-11** on the reply card.

• • •

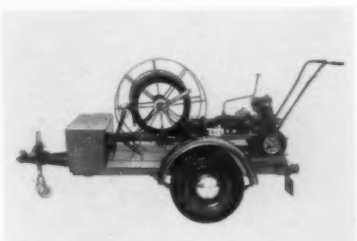
Hough tractor-shovel has a bucket capacity of 2¼ yards and comes with power-shift. Check **No. 6-12** on the reply card for data on this machine

Four New Defoamers For Sewage

A new line of defoamers for use in activated sludge plants has been developed for use on industrial wastes and sewage by Swift & Company. Available in four grades for a variety of uses, the new products are effective when used in concentrations as low as 1 part per million. There are several methods of adding the defoamers at the plant. For full details write Swift & Co., Industrial Oil Dept., 1800—165th St., Hammond, Indiana, or circle **No. 6-13** on the reply card.

Gasoline-Powered "Electric Eel"

A new gasoline-powered Model No. 200 Electric Eel has been especially designed for "on the job" threading and cleaning of storm and sanitary sewers. It can be moved



Open sewer stoppages with this unit

easily to any location, and its self-contained power source makes it ready for use anywhere. One man can operate the machine. The power unit is mounted on a pneumatic tired cart, and features a Clinton 2 hp 4-cycle back-geared engine with a foot-operated clutch. Three speeds forward, 150 rpm, 250 rpm and 500 rpm, and a reverse speed of 150 rpm are provided. A dual cable is used and is self feeding in both directions. The cable comes in 8-foot sections with snap-lock connectors, allowing the cable sections to be joined in a matter of seconds. A complete line of tools are available for threading and cleaning. These fit the cable for use in sewer lines up to 16 inches in diameter. Complete information from the Ohio Tool and Engineering Company, 128 North Spring Street, Springfield, Ohio or circle **No. 6-14** on the reply card.

Rotary Cutter For Maintenance Crews

The new five-foot lift-type BMB "Special" rotary cutter provides caretakers and maintenance crews with an easier and more economical way to control undergrowth. It is light in weight, easy to assemble

Equipment for weed and grass control

and operate. A three-point hook-up attaches quickly to any type tractor. The machine has full length skid shoes, and one pair of swinging-type blades that contract automatically when an obstruction is hit. Extra blades, an over-running clutch, gauge wheel, carrier bar, adjustable chain top link and shredding bars are available as optional equipment. For complete information write the BMB Co., Inc., 319-21 New York Avenue, Holton, Kansas, or circle **No. 6-15** on the reply card.

Hydrogen Sulphide Detector

Development of an improved type, hand-operated detecting instrument for hydrogen sulphide has been announced by Mine Safety. Principal feature of the new instrument is a dual scale to provide accurate reading in percentages by volume or in grains per hundred cubic feet. The percentage graduations on the scale enable use of the instrument for detection of hydrogen sulphide concentrations as low as 0.0025 per cent and up to 0.04 per cent by volume. This provides a simple and quick means of detecting and accurately measuring the hazardous gas in atmosphere around working locations. For full details write Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 2, Pa., or circle **No. 6-16** on the reply card.

• • •

Seven-foot blade attachment is being used here to grade a road and it is interchangeable with a half-yard material bucket and mounted on a IHC 300 tractor. Check **No. 6-17** on the reply card for details on these units

Bulldozer Tilting Attachment

A new hydraulically actuated bulldozer tilting attachment for use with No. 9S and 8S bulldozers has been announced by Caterpillar. The new attachment is designed to give D8 and D9 Tractors increased versatility on such jobs as ditching, working on hillsides, digging rocks and other applications which require frequent tilting of the blade. The tilting attachment is a large hydraulic cylinder which replaces the left bulldozer blade brace. With the right-hand brace adjusted to its neutral position, either corner of the blade can be raised approximately 28 inches above ground level by retracting or extending the tilt cylinder. The tilt cylinder is controlled from the operator's seat by means of a front or rear mounted hydraulic control. For more details write Caterpillar Tractor Co., Peoria, Ill., or circle **No. 6-18** on the reply card.

Tractor Loader and Backhoe

The Wagner W7 tractor loader and W30 backhoe have been approved for the International "400" tractor. The Wagner W7 loader is a heavy-duty loader that features the "Step-In" frame design. It permits easy side-mounting plus convenient use of additional tractor equipment. In addition, powerful down-pressure side cylinders give the loader greater digging and lifting power. The backhoe is designed for efficient digging of sewer, gas and power lines, foundations and footings, drainage ditches and culverts, landscaping holes, septic tanks and other digging jobs. The unit digs to a clean depth of 12 feet, and lifts a full bite up to 9 feet 3 inches. For further information write Wagner Iron Works, 1905 South First Street, Milwaukee 1, Wisconsin, or circle **No. 6-19** on the reply card.

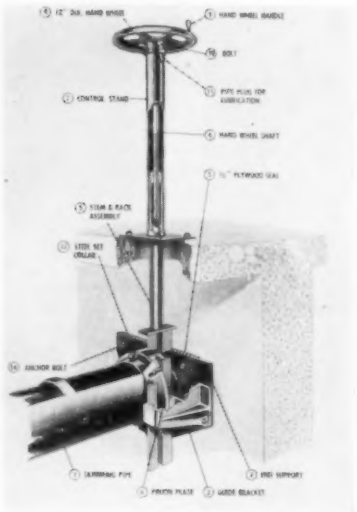
Water Meter Testing Device

The Chart-A-Meter announced by the H. E. Anderson Co., is a simple device easily attached to water meters that graphically portrays the time and flow of water through any given meter installation. It is a compact precision instrument, and is simple to install—just remove the meter register and attach. The device will fit any make or size water meter through the use of adap er plates. Rather than using ordinary charts with a capillary pen and ink, the Chart-A-Meter charts are made of a specially coated paper which is marked by a stylus. This eliminates any chance of the chart becoming

smeared. The chart is turned by an eight day wind clock, with twenty-four hour rotation chart drive. For further information write H. E. Anderson Co., P. O. Box 1183, Muskogee, Okla., or circle **No. 6-20**

Chain Belt Scum Remover

A new Roto-Skim that is operated on the rack and pinion principle has been announced by Chain Belt. The Roto-Skim is a slotted pipe that removes scum from the surface of primary waste treatment tanks and recovers by-products in API tanks.



It is ideally suited to those primary waste treatment tanks where the freeboard is in excess of three feet. A handwheel activates the pinions which in turn control the rotation of the Rex-Roto-Skim pipe. The Rex rack and pinion Roto-Skim can be accurately adjusted to the liquid level to make efficient skimming quick and simple. For full details write Chain Belt Co., Dept. PR, Milwaukee 1, Wisc., or circle **No. 6-21** on the reply card.

New Heavy-Duty Trucks

A new "V-Line" of International heavy-duty trucks, featuring three new V-8 engines, are available with gross vehicle weight ratings of 24,000 pounds and up, and gross combination weights of 50,000 pounds and up. With horsepower ratings from 206 to 257, the V-Line models are new and distinctive and feature the famous Comfo-Vision cab. The power plants are additions to the line of six-cylinder Red Diamond gasoline and liquified petroleum gas

Backhoe and loader is used for maintenance or construction

Trucks designed and built specifically for heavy trucking

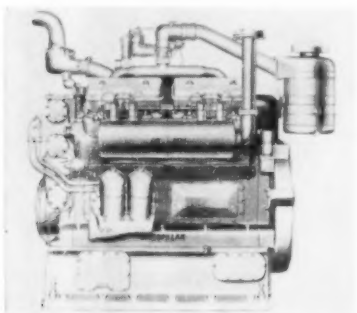
engines, and diesel engines available in the International heavy-duty truck models. For further details write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 6-22** on the reply card.

Mower-Shredder With Caster Wheel

The new style caster wheel on the Wood's rotary mower-shredder enables the cutting height of the mower to be adjusted very quickly by loosening one nut, moving the wheel up or down and retightening the nut. The wheel swivels 360 degrees and has a non-pneumatic puncture-proof tire with Timken bearings. The complete caster wheel weighs 83 pounds and can be used with all Wood's tractor-mounted mowers with 61 and 80-inch cutting swaths. For complete details write Wood Brothers Mfg. Co., Oregon, Ill. or circle **No. 6-23** on the reply card.

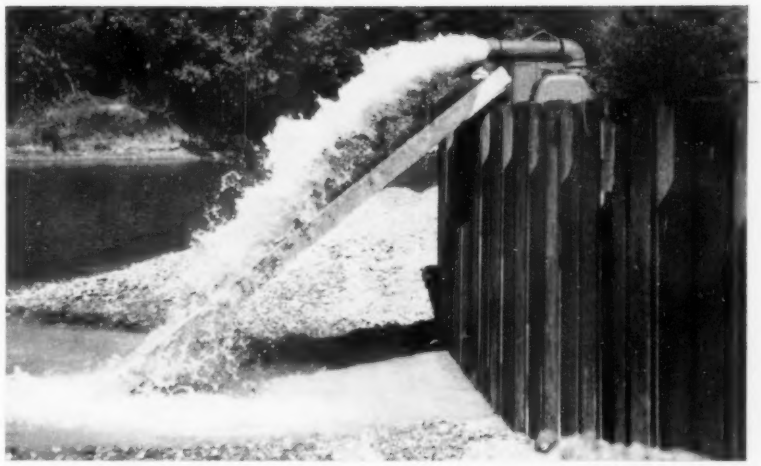
Cat Self-Regulated Generators

Two new heavy-duty V-type engines have been announced by Caterpillar. Available in turbo-



Engine has a 10 to 1 compression ratio

charged, roots-blown, naturally aspirated and spark ignited versions, the new eight and twelve cylinder D375 and D397 engines are of four-cycle design and produce 267 and 400 hp respectively. Using natural gas as fuel they have a 10 to 1 compression ratio, a low-tension magneto ignition system and new type pistons. The new engines are especially suited for driving pipeline pumps, and for sewage disposal plants, municipal pumping stations and stationary irrigation systems. The generators are of single bearing design, close coupled to the engine and have top mounted exciters. For literature and information write Caterpillar Tractor Co., Peoria, Ill., or circle **No. 6-24** on the reply card.



Jaeger pumps know how to handle water

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KEEPS ROADS and STREETS FREE of ICE and SNOW ALL WINTER LONG!

Gives you safe, bare streets all winter long at *lower cost*, in *less time*, with *less labor*. With the stainless steel Scotchman, you can salt-treat streets and highways *8 times faster* . . . up to 20 miles of highway in 48 minutes. Blower *spreads* full *30 ft. wide* in a perfect "Bird Shot" melting pattern . . . uses as little as ½ ounce of salt per square yard.

Your choice of: Cab Control or manual operation. New Cartridge Type Power Unit: engine, electric starter, and impeller is a single compact unit . . . can be removed or installed in less than 5 minutes . . . for simple and quick servicing. Ask your dealer or write for details.

TARRANT MANUFACTURING COMPANY
28 Jumel Pl., Saratoga Springs, N. Y.

Now's the time to mail this month's Readers' Service card.

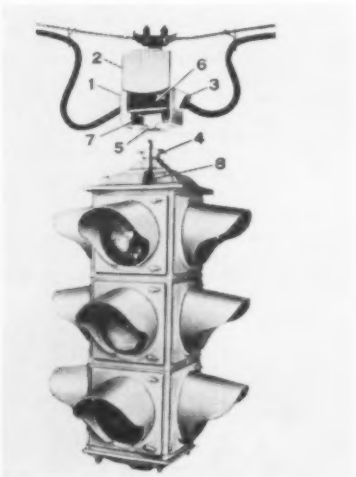
Loader can be used to level highway shoulders, clean ditches, remove snow

Mobil-Loader Digs And Loads Up to 4 Yds. A Minute

A new tractor pulled industrial loader that digs and loads up to 4 cubic yards a minute has just been introduced by J. R. Prewitt. Known as the Willimon Mobil-Loader, the new machine easily hooks on the draw bar of any tractor having PTO. It handles any windrow up to 48-inches wide and has a loading discharge height of approximately 8 feet. The rotary tiller, digs up to 6-inches deep and cuts a swath 24-inches wide. The loader is a useful year-around machine for cities, counties and contractors. It not only digs and loads original soil but mixes and loads sand, clay and top soil, levels shoulders on highways, cleans out ditches and it is an excellent tool for snow removal. For additional information write J. R. Prewitt and sons, Pleasant Hill, Missouri or circle **No. 6-25** on the reply card.

Traffic Signal Hanger Simplifies Installation and Maintenance

Installation and maintenance of suspended traffic signals are simplified through the use of a disconnecting hanger featuring a multi-circuit jack connector mounted within the hanger just introduced by Crouse-Hinds. The installation of this hanger is very simple. The hanger body (1) is a one-piece casting to which the door (2) is attached by a single thumb screw. A cable entrance (3) fitted with an insulating bushing, is provided on each side of the hanger body. A special hub plate (4) takes the place of the usual wire outlet and this hub plate rests in a socket (5) in the bottom of the hanger casting. Connections may be made quickly and easily, since the hanger is equipped with a 12-terminal connection block (6) of the pressure type for the incoming signal cable. This connector is indispensable to cities having a regular program for cleaning and painting of traffic signals. For further information, write Crouse-Hinds Co., Wolf & Seventh North Streets, Syracuse, N. Y., or circle **No. 6-26** on the reply card.



Sewer Cleaning Attachment

The power drive with Flexspeed Drive that can be used for regular sewer work, or high speed rotation of both Flexicrome and 1-inch coiled rods is introduced by Flexible. The attachment is used primarily for turning coiled rods to clean traps and 90° bends in 4 and 6-inch pipe. The unit will attach to any PD-50 Power Drive that is now in use, and it can be attached in 15 minutes. For full information write Flexible Inc., 3786 Durango Ave., Los Angeles 34, Calif., or circle **No. 6-29** on the reply card.

Metallizing Machine Features Simplified Air Governor Control

One of the unique engineering features of the new Vanco Metallizing Machine is the air governor control. The dynamically balanced air turbine provides positive power control uniformly feeding metal wire without fluctuation, an important factor in the operation of a metallizing machine. Other improved features are the self contained gas mixing chamber nozzle that eliminates danger of backfire hazards and lightweight construction (under 4½ pounds) to reduce operator fatigue. For full details write the Vandersee Corp., Route 22, Union, N. J. or circle **No. 6-27.**

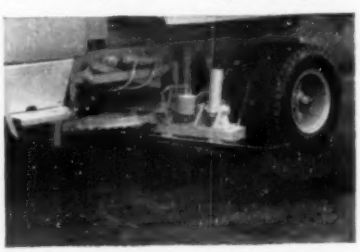
Pocket Penetrometer

A new pocket penetrometer for field and laboratory classification of cohesive types of soil has been introduced by Soiltest. Civil engineers, scientists, testing laboratories, construction inspectors, contractors and military engineers can obtain uniformity in soils classification and evaluation by using this instrument. It is practical for evaluating the shearing strength of soil in field exploration or on construction sites

and in preliminary soil laboratory studies. Technique of operation is very simple. It weighs only four ounces, has a diameter of ¾-inch and is less than 7½-inches long. For full details write Soiltest, Inc., 4711 W. North Ave., Chicago 39, Illinois or circle **No. 6-28** on the reply card.

Year Around Maintenance Unit

A year-around maintenance unit is the new Wausau truck patrol ice planer. Designed to maintain roads, streets and airports at speeds from six to twenty miles per hour, it cuts and grades all types of gravel



and dirt roads, eliminates ruts, holes and washboards. For winter operation it planes, breaks and removes ice and hard-packed snow hazards. Hydraulic controls from the cab permit the operator to reverse, tilt and rotate the working blade. Mounted under the truck, extra weight can be added for doing heavy cutting necessary in ice planing and the more difficult jobs. Full data from Wausau Iron Works, Wausau, Wisconsin, or circle **No. 6-30** on the reply card.

Portable Truck Loading Hoist

A new 500 lb. capacity hand operated portable truck loading hoist is announced by Burtchaell Heating Co. The 500 lb. lift is made possible with less than a 30 lb. crank effort and a special snatch block is available which further reduces the crank effort. The hoist is easily removed from the mast well to provide a clear truck bed and it is easily installed and can be used on a shop dolly. For complete information write Hoist Division, Burtchaell Heating Co., 2944 S. E. Powell, Portland, Oregon, or circle **No. 6-31** on the reply card.

Loader with 1 Yd. Capacity

Four-wheel steering, two axle oscillation and unimpaired operator visibility are features of the new model LS5T Scoopmobile. This model is a 1-yard, 5000-lb. capacity front end loader, which will transport a full load with the bucket barely raised off the ground. Four-wheel steering permits the operator to get around better in tight spots and rough terrain. Standard equipment is torque converter, planetary drive, power steering, reversing transmission, two-axle oscillation, four-wheel drive, four-wheel steering and four-wheel brakes. Complete details from Mixermobile Manufacturers, Inc., Portland 20, Oregon, or circle **No. 6-32** on the reply card.

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Degree in Civil Engineering desirable. Experience in Municipal Construction and Maintenance of Streets, Water and Storm Sewers necessary. Will have charge of Streets, Trash and Garbage Collections, City Shop, Building Maintenance and Water Department. Growing Florida City, estimate present population 15,000. Beginning salary $500 per month. *Apply to:*

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City Manager
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Must have broad experience in all types of Municipal Engineering. Will have charge of Public Works construction and maintenance, including streets and airport; supervise inspection division, including building, electric, plumbing, and gas installations. Must be able to obtain registration in Colorado. Assistant Building Inspector also needed.

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W. D. TOYNE, CITY MANAGER
CITY OF GRAND JUNCTION
GRAND JUNCTION, COLORADO

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Permanent, Civil Service status, vacation, sick benefits, pension, etc. Salary—open.

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SOUTH BEND FOUNDRY CO.
Gray Iron and Semi-Steel Castings
SOUTH BEND 23, INDIANA

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INDEX OF ADVERTISEMENTS

Abrams Aerial Survey Corp. 189
Adams Co., Inc., R. P. 30
Air Survey Corp. 189
Air Placement Equipment Co. 27
Alabama Pipe Co. 40
Albright & Friel, Inc. 189
Allis Chalmers ..... 35 & 41
Alster & Associates, Inc. 189
Alvord, Burdick & Howson 189
American Bitumuls & Asphalt Co. 59
American Hot Dip Galvanizer Assoc. 76
American-Marietta Co. 157
American Public Works Assoc. 128
American Vitrified Products Co. 45
Anthracite Equipment Corp. 170
Armco Drainage & Metal Products, Inc. .. 85
Asphalt Institute ..... 10 & 11
Asplundh Chipper Co. 18
Automatic Signal Division Eastman Industries, Inc. 55
Ayer-McCarel Clay Co., Inc. ..... 12 & 13

B.I-F Industries 169
B-M-B Company, Inc. 30
B/W Controller Corp. 128
Badger Meter Mfg. Co. 133
Baker, Jr., Michael 189
Bannister Engineering Co. 189
Barber-Greene 82
Barker & Wheeler 189
Barstow & Associates, E. D. 189
Bell, Howard K. 189
Black & Veatch 189
Blackburn-Smith Mfg. Co. 185
Blaw-Knox Company ..... 34 & 156
Bogert & Childs 189
Bowe, Albertson Assoc. 189
Bowerston Shale Co. ..... 12 & 13
Brown & Assoc., Floyd G. 189
Brown & Blauvet 189
Brown Company 77
Brown Engineering Co. 189
Buchart Engineering Corp. 189
Buck, Seifert & Jost 189
Builders-Providence 169
Burgess & Nipple 190
Burke, Inc., R. H. 190
Burns & McDonnell Engr. Co. 190
Butler Mfg. Co. 202

Caird, James M. 190
Calgon, Inc. 175
Camp, Dresser & McKee 190
Cannelton Sewer Pipe Co. ..... 12 & 13
Capitol Engineering Corp. 190
Cast Iron Pipe Research Assoc. ..... 8 & 9
Caterpillar Tractor Co. ..... 4, 86 & 155
Centrline Corporation 150
Chapman Valve Mfg. Co. 149
Chester Engineers 190
Chicago Bridge & Iron Co. 173
Chicago Pump Co. 3
Clark-Wilcox Co. 48
Classified Ads 199
Cleveland Trencher Co. 22
Climax Engine & Pump Mfg. Co. 144
Clipper Mfg. Co. 46
Clow & Sons, James B. 171
Cole & Sons, Chas. W. 190
Cole Mfg. Co., R. D. 46
Columbia-Southern Chemical Corp. 31
Consoer, Townsend & Assoc. 190
Conveyor Company 33
Cotton, Pierce, Streander, Inc. 190

Darby Corp. 136
Darling Valve & Mfg. Co. 14
DeLeuw, Cather & Co. 190
Diamond Alkali Company 36
Dickey Clay Mfg. Co., W. S. ..... 12 & 13
Dorr-Oliver, Inc. 131
Dotmar Industries Inc. 130
Drott Mfg. Co. ..... 16 & 17
E. I. Du Pont 58
Grasselli Chemicals Dept.

Everson Mfg. Co. 138

Fairbanks-Morse & Co. ..... 28 & 29
Fay, Spofford & Thorndike Inc. 190
Finkbeiner, Pettis & Strout 190
Fischer & Porter Company 182
Fitchburg Engineering Corp. 23
Flexible, Inc. 165
Ford Motor Company ..... 47, 52 & 53
Foster Engineering Co. 187
Foxboro Company 183
Fridy, Gauker, Truscott & Fridy, Inc. 190

Gannett, Fleming, Cordroy & Carpenter, Inc. 191
Gar Wood Industries ..... 84 & 145
General Electric Co. ..... 68 & 69
Gilbert Associates, Inc. 191
Golden Anderson Valve Specialty Co. 168
Gorman-Rupp Company 146
Grace Sign & Mfg. Co. 30
Graham Parking Engineers 190
Gray & Osborne 191
Greeley & Hanson 191
Green Co., Howard R. 191
Greenlee Bros. & Co. 132
Greer Engineering Assoc. 191
Gulf Oil Corp. 67

Hagan Corporation 175
Hamilton Kent Mfg. Co. 2
Harley & Assoc., Frank E. 191
Harnischfeger Corp. 61
Hauck Mfg. Co. 168
Havens & Emerson 191
Hays Process Company 132
Hazen & Sawyer 191
Healy Ruff Co. 138
Heil Company 151
Heltzel Steel Form & Iron Co. 66
Henningson, Durham & Richardson, Inc. .. 191
Hill & Hill 191
Holmes Company, Ernest 54
Homelite ..... 140 & 141
Div. of Textron American, Inc.
Hotel Jefferson 199
Hough Co., Frank G. ..... 20 & 21
Huber-Warco Company 83
Hurd Aeriel Surveys, Inc., Mark 191

International Harvester Co. ..... 16 & 17
International Salt Company 15
Irving Subway Grating Co., Inc. 60

Jaeger Machine Co. 197
Jeffrey Mfg. Co. 81
Johns-Manville 153
Johnston Pump Co. 139
Jones Henry & Williams 191
Josam Mfg. Co. 74

Kennedy, Clyde C. 191
Kerrigan Iron Works, Inc. 75
Knowles, Inc., Morris 191
Koehring Company 40

Lakeside Engineering Corp. 185
Layne & Bowler Pump Co. 38
Leopold F. B. 44
Le Roi 39
Div. of Westinghouse Air Brake Co.
Le Tourneau-Westinghouse Co. ..... 160 & 161
Lewis, Harold M. 191
Link-Belt Co. 6
Littleford Bros., Inc. 135
Lozier & Co. Wm. S. 191
Lyle Signs, Inc. 138

Maintenance Co., Inc. 199
Mall Tool Company 75
M-B Corp. ..... 127 & 165
M & H Valve & Fittings Co. 176
Mebus George, Inc. 191

Merritt & Welker 191
McWane Cast Iron Pipe Co. 180
Metcalf & Eddy 191
Mid-Western Industries, Inc. 147
Modern Swimming Pool Co., Inc. 80
Mueller Co. 25

Natco Corp. ..... 12 & 13
National Clay Pipe Mfrs., Inc. 137
Neptune Meter Company 203
Nichols Engineering & Research Corp. 78
Northern Gravel Co. 24
Norton Company 63

Olin Mathieson Chemical Corp. 79
Orangeburg Mfg. Co., Inc. 56

Pacific Coast Borax Co. 159
Pacific Flush Tank Co. 181
Pacific States Cast Iron Pipe Co. 180
Palmer & Baker, Inc. 191
Palmer Filter Equip. Co. 48
Peerless Pump Division 57
Permutit Company 177
Pfaff & Kendall 65
Phelps, Inc., Boyd E. 191
Pirnie Engineers Malcolm 191
Pitometer Company 191
Pomona Terra-Cotta Co. ..... 12 & 13
Preload Company, Inc. 42
Public Works ..... 188 & 199

Radiator Specialty Co. 130
Ridge Tool Company 147
Ripple & Howe, Inc. 192
Robert & Co., Associates 192
Roberts Filter Mfg. Co. 44
Russell & Axon 192

Schlueter Mfg. Co. 50
Seaman-Andwall Corp. 37
Seay Co., Irby 192
Seeye, Stevenson, Valve & Knecht 192
Servicised Products Corp. 62
Sherman Products, Inc. 162
Skinner, M. B. Co. 167
Smith & Gillespie 192
South Bend Foundry Co. 199
Standard Dry Wall Products, Inc. 26
Stanley Engineering Co. 192
Stillson Assoc., Alden E. 192
Sunflower Industries, Inc. 49
Synchro-Start Products, Inc. 170

Tarrant Mfg. Co. 197
Tennant Company, G. H. 164
Tennessee Corp. 71
Texas Vitrified Pipe Co. ..... 12 & 13
Trickling Filter Floor Institute ..... 12 & 13
Twin City Pigeon Eliminating Co. 192

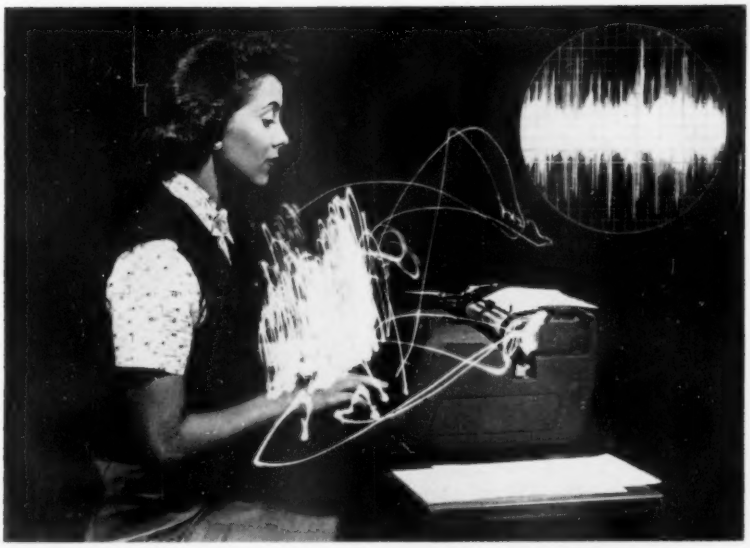
Uhlmann & Associates 192
United Steel Fabricators 64
U. S. Concrete Pipe Company 51
Universal Sewer Pipe Corp.
U. S. Pipe & Foundry Co. 143

Veon Chemical Corp. 158

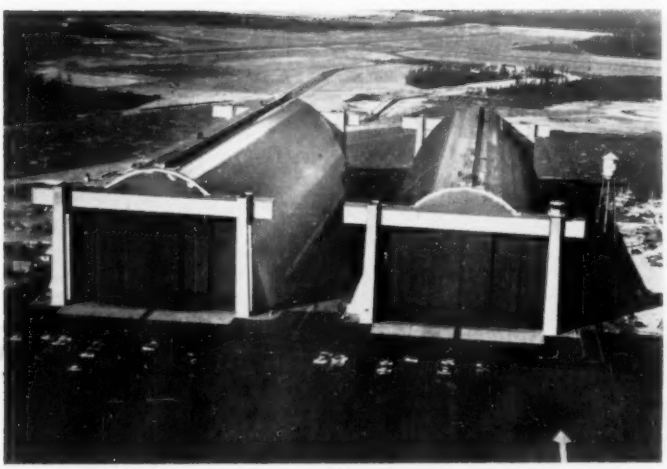
Wagner Iron Works 43
Wallace & Tiernan Incorporated ....Back Cover
Watkins, J. Stephen 192
Westinghouse Electric Corp. ..... 72 & 73
White Motor Company 70
Whitman, Requarpt & Assoc. 192
Williams & Associates, Clyde E. 192
Willys Motors, Inc. 19
Woodward Iron Co. 172
Wright Engineers 192
Wyandotte Chemicals 186

Yeomans Brothers Co. 179

Worth Seeing

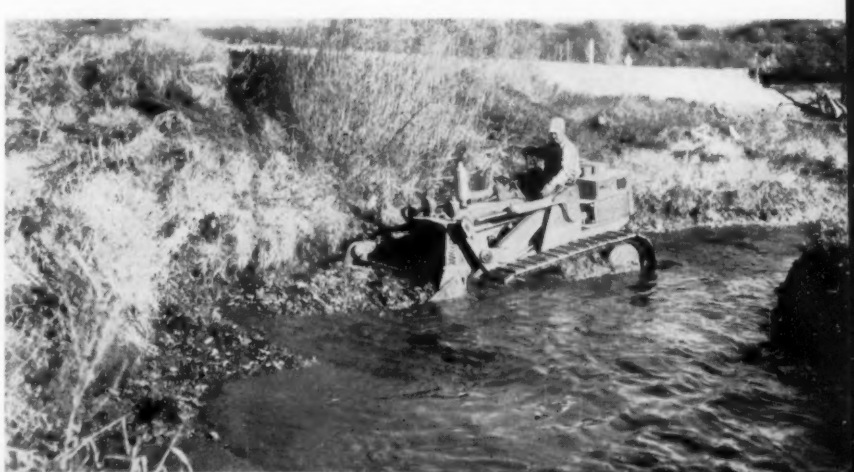


Why are even the best looking typists so tired at the day's end? The squiggles on this picture show in light the excessive motions involved in copying just 3 lines. Many remedies have been suggested but the best one seems that of American Photocopy Equipment Co., Chicago 26. It is: Don't type it; make an easy photo-copy.



An aluminum roof system has been applied to the blimp hangars at the Naval Air Station, Lakehurst, N. J. The two wooden structures were covered with aluminum to solve roofing problems resulting from heavy winds and roof movement. Photo courtesy Aluminum Co. of America.

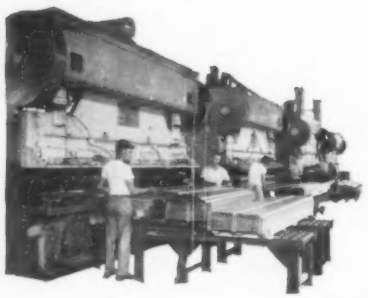
Not a king-sized back scratcher, but a Warner & Swasey "Gradall" equipped with an 18-foot extension boom and used to remove rock from a steep slope above a new road in San Fernando Valley.



Submarine tractor? Cleaning a water sump and deepening a passage from it to the Iowa River, this International Drott TD-9 4-in-1 skid-shovel works effectively under adverse conditions. Owned by the City of Decorah, Iowa, the rig operates in water a great deal of the time, digging gravel from the channel bed and doing many other jobs.

Don't build an eye-sore

for beauty



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See "Buildings" in the yellow pages of your phone book for name of your Butler Builder.

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WORTH TELLING

by Arthur K. Akers

★ GENE R. JOHNSON is this month's addition to PUBLIC WORKS' advertising sales staff, located in Chicago to assist our Mid-West Advertising Manager, Robert J. Shea, with headquarters at 612 North Michigan Avenue.

★ PHILIP R. HIRSH, formerly vice president in charge of sales, Lock Joint Pipe Company, East Orange, N. J., has been elected executive vice president.

Blackstone Studios

Mr. Hirsh Mr. Parcell

★ WILLIAM L. PARCELL has been named vice president, The Ridge Tool Co., Elyria, Ohio. He continues as director of sales also.

★ THE ASPHALT INSTITUTE, College Park, Md., launches this month a $600,000 advertising campaign aimed at winning popular support for modern heavy-duty asphalt paving. Their first magazine ads are appearing all the way from this issue of PUBLIC WORKS to LIFE, plus use of billboards and radio.

★ HAROLD A. JONES is promoted to national sales manager, Motorola Communications and Electronics, Inc., Chicago.

Mr. Jones Mr. Birdsall

★ F. D. CUMMER & SON CO., Cleveland, pioneer developers of asphalt plants, appoint Robert N. Birdsall vice president and general manager.

★ KENNETH C. SANDERS is new manager of advertising and market research of The Heil Co. (Colectomatic refuse collection units), Milwaukee.

★ WORTHINGTON CORPORATION appoints A. William Fraser and Clarence S. Wentworth as new commercial vice presidents in charge of certain district sales offices, with headquarters in Chicago and Cleveland respectively.

★ A MAN with a little black bag knocked at the front door. "Come in, sir, come in," said the father of fourteen, "and I sure *hope* you are the piano tuner."

—*N. D. Coarse Screenings*

★ A PARTIAL VIEW of the large new plant addition of The Conveyor Co., Los Angeles, to meet the demand for their Mobil Sweepers. Los Angeles is reported to have more street sweepers than any city except New York, 19 of them Mobil Sweepers.

THIS OPEN DOOR GUARDS YOUR MOST VITAL SERVICE

Water is your community's life blood. Water meters are universally accepted as the fairest way to charge for water . . . and the only way to keep people from wasting water.

But water meters, being fine instruments, naturally lose accuracy after years of wear. They start to give away revenue. They permit leaks and carelessness to creep back, and pumping costs go up. Eventually the water system cannot cope with the growing demand.

Worse yet, lack of proper income makes people hesitant to act, and water shortages may soon become critical.

How guard against this? Pick meters that stay accurate longer. Set up a good testing and repair program.

Walk into your meter repair shop. Talk to the men whose efforts guard your water supply. Ask them which meter gives highest sustained revenue . . . with lowest repair and depreciation costs. We sincerely believe the answer will be "Trident."

276

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities.

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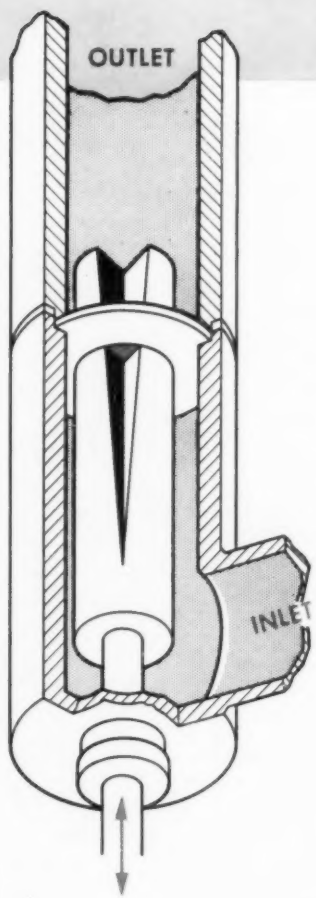
THE WALLACE & TIERNAN

V-NOTCH

variable-orifice

. . . a new concept for chlorinator control



The W&T V-notch Variable-Orifice is the heart of a new chlorinator control system. With the system, a constant differential vacuum is maintained across the V-notch Variable-Orifice and the flow of chlorine gas is adjusted by varying the area of the orifice.

The W&T V-notch Variable-Orifice has these features:

- Wide range adjustment of chlorine flow
- Excellent reproducibility of flow by a simple adjustment
- Same % accuracy over entire wide flow range

As can be seen in the diagram, the V-notch Variable-Orifice is formed by a cylindrical plug positioned inside a matched, circular ring. A V-shaped groove is machined along the length of the plug. The groove starts near one end of the plug and gradually enlarges to its maximum width and depth at the other end of the plug. The V-notch Orifice is formed at the intersection of the grooved plug and the matched ring. The orifice area is varied simply and positively by positioning the plug backward or forward inside the fixed ring.

The V-notch Variable-Orifice is just one design feature of the new W&T V-notch line of chlorinators. Get all the facts about the W&T V-notch chlorinators before you buy chlorination equipment.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

S-107